DOCUMENT RESUME

ED 192 819 IR 008 908

AUTHOR Elliott, T. Michael; And Others
TITLE Report to the Coordinating Board for Higher Education of the Computer Policy Task Force.
INSTITUTION Missouri State Dept. of Higher Education, Jefferson City.
PUB DATE Aug 79
NOTE 225p.; Chapter 1 and appendices are printed on colored paper and may not reproduce.

EDRS PRICE MF01/PC09 Plus Postage.
DESCRIPTORS *Computers; Cooperative Planning; *Higher Education; Needs; Questionnaires; State Surveys; Tables (Data); *Use Studies
IDENTIFIERS Missouri

ABSTRACT

The results of a year-long study on the use of computers at institutions of higher learning in Missouri are detailed. The task force which conducted this project was charged with the creation of an atmosphere of cooperation and resource sharing, the improvement of the cost effectiveness of computing services, and the identification of areas of unmet needs and consideration of new and/or innovative ways of using computing to meet those needs. To this end, existing information was reviewed, and five surveys of institutions in the state sector were conducted. Final recommendations focused on two main areas: the establishment of a facilitating organization and the sharing of computer resources. The task force recommended that the Coordinating Board for Higher Education create a state-wide higher education computer consortium in Missouri which would have four primary functions: (1) to serve as an information clearinghouse for higher education computing, (2) to facilitate the development and support of academic and administrative computing, (3) to provide a formal voice for higher education computing in the state, and (4) to encourage the development of appropriate levels of computing resources at all colleges and universities. (Author/LLS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED1928819

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

REPORT TO THE

COORDINATING BOARD FOR HIGHER EDUCATION

OF THE

COMPUTER POLICY TASK FORCE

BEST AVAILABLE COPY

T. Michael Elliott
Chairman

Thomas Allen
R. Bruce Briggs
James R. Buchholz
Ken Hawk
Darrell W. Krueger
Aldo Leker
Mick Long
B. D. Owens
Rus Slicker
Jack Thompson
Richard L. Wallace

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Barbara DeVeaux Holmes

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

August 1979

MISSOURI DEPARTMENT OF HIGHER EDUCATION
600 Monroe
Jefferson City, Missouri 65101

IR008908

INTRODUCTION

The completion of an activity such as the Computer Policy Task Force study is naturally accompanied by a feeling of satisfaction on the part of those involved. In this instance, however, those feelings are especially profound. Many cross currents of conflicting interests and aspirations were thrown into the crucible of Task Force deliberations. Added to these were the difficulties posed by a highly technical, complex subject, and an environment characterized by such rapid technological change that few definite assertions can be made about the future other than the constancy of that change. At some point during the past year probably most members of the Task Force were skeptical of any productive outcome. Yet, in the end, a report has been agreed to which rather than attempting itself to deal with all issues, sets forth a workable means of dealing with both current and future issues. The Task Force membership rose to meet the significant challenge posed to them by the Coordinating Board for Higher Education, and that Board and the Missouri Department of Higher Education which it heads are indebted to the Task Force members for their efforts.

On behalf of the Computer Policy Task Force, acknowledgment must be made of the contributions of a number of persons to our work. The two consultants who met with the Computer Task Force at all of its meetings, who prepared materials for us and who critiqued materials prepared by others, were Don Norris and Lou Parker. It would be difficult to overestimate the value of their contributions, and they are gratefully acknowledged. Other resource persons who shared insights from experiences in their respective states were Dale LaFrenz (Minnesota), Walt Parrill (Illinois), and Chuck Shomper (West Virginia). John Hamblen of the University of Missouri-Rolla shared with the Task Force the fruits of his national research on higher education computing, and, together with his colleague Thomas Baird, provided useful guidance to the staff effort supporting the Task Force. Richard Heydinger shared his personal library of computing studies and plans from other states with the Task Force, an exceptional resource not otherwise available. The Computer Center Directors Council, chaired by Jack Thompson of Southeast Missouri State University, provided timely reactions to the study plan, survey instruments, objectives statements, and recommendations throughout the process of the study. Several members of the Missouri Department of Higher Education staff were helpful in critiquing Task Force materials from the early design stage through this final report. Particularly useful were comments and critiques received from Loretta Glaze Elliott, Director of Research and Planning.

Several persons, though not formally members of the Task Force, worked with the Task Force through the complete study as "participant observers" and are identified in Appendix A. Stan Koplik, MDHE Director of Fiscal Affairs, was active throughout the study as was Mike Boxberger of the

Office of Administration Division of Electronic Data Processing Coordination. Special mention, however, must be made of the contribution of Robert Benson of Washington University, who represented the Independent Colleges and Universities of Missouri. From the first meeting through the last, Bob's perspective and insights were singularly useful in moving the Task Force study forward.

Although this report is in itself large, it represents a small fraction of the total materials prepared either for the consideration of or by the Task Force. Typing and other clerical assistance throughout the process was provided by the MDHE clerical staff in an exceptional manner. Darlene Hunt, Suzie Stegner, and Fran Trainer especially have nursed the current report and its predecessor documents with good humor and great competence through more drafts than any of us care to count.

Finally, on behalf of the Task Force we must acknowledge our debt to Edward P. St. John, MDHE Associate Director of Research and Planning. From arranging meetings, organizing agendas, scheduling presentations, conducting research, analyzing data, through drafting the final report, the real burden of the staff effort has fallen to Ed who has performed in an exemplary manner. It is not an overstatement to suggest that the success of the Task Force effort is in large part due to the efforts of Ed St. John.

To all of these persons we express our gratitude and acknowledge our debt, but in the end it is the members of the Computer Policy Task Force who accept responsibility for the contents of this report, including any errors contained therein.

Respectively submitted to the Coordinating Board for Higher Education, August 10, 1979.

T. Michael Elliott
Chairman
Computer Policy Task Force
Deputy Commissioner
Missouri Department of Higher Education

CONTENTS

		Page
INTRODUCTION		iii
List of Tables		vi
List of Appendices		vii
Chapter I	SUMMARY	1
Chapter II	THE CONTEXT FOR STATE-WIDE PLANNING	13
Chapter III	THE COMPUTER POLICY TASK FORCE STUDY OF COMPUTING IN MISSOURI HIGHER EDUCATION	28
Chapter IV	COMPUTING IN MISSOURI HIGHER EDUCATION: THE STUDY RESULTS	32
Chapter V	STATE-WIDE OBJECTIVES FOR HIGHER EDUCATION COMPUTING IN MISSOURI	62
Chapter VI	FACILITATING COOPERATIVE COMPUTING IN MISSOURI HIGHER EDUCATION	67
Chapter VII	RECOMMENDATIONS	75
Appendices		

LIST OF TABLES

		Page
TABLE 1.	RESPONSE TO FICHE SURVEY FOR MISSOURI	33
TABLE 2.	MISSOURI USE OF OFF-CAMPUS COMPUTING FACILITIES	34
TABLE 3.	MISSOURI ESTIMATED NUMBERS OF INSTALLATIONS WHICH USE INTERACTIVE AND REMOTE COMPUTING	36
TABLE 4.	MISSOURI ESTIMATED NUMBER OF EMPLOYEES IN COMPUTER CENTERS	36
TABLE 5.	MISSOURI ESTIMATED EXPENDITURES FOR COMPUTING AND ESTIMATED FUNDS FOR COMPUTING, BY SOURCE (DIRECT COSTS ONLY)	37
TABLE 6.	ESTIMATED COMPUTER MANPOWER NEEDS AND ESTIMATED PRODUCTION FOR 1976-77 BY POSTSECONDARY INSTITUTIONS BY STATES	40
TABLE 7.	LISTING OF PROGRAMS IN COMPUTER AND INFORMATION SCIENCES	42
TABLE 8.	LISTING OF PROGRAMS IN DATA PROCESSING TECHNOLOGIES	43
TABLE 9.	HEADCOUNT ENROLLMENT AND DEGREES AND OTHER FORMAL AWARDS CONFERRED IN 5100, DATA PROCESSING TECHNOLOGIES	44
TABLE 10.	HEADCOUNT ENROLLMENT AND DEGREES CONFERRED IN 0700, COMPUTER AND INFORMATION SCIENCES	46
TABLE 11.	STUDENT ACCESS TO COMPUTING RESOURCES	48
TABLE 12.	COMPUTING SKILL LEVEL OF STUDENTS	51
TABLE 13.	ACCESS TO COMPUTING FOR INSTRUCTION	51
TABLE 14.	STUDENT RESEARCH USE OF COMPUTING	51
TABLE 15.	MANAGEMENT INFORMATION SYSTEM DEVELOPMENT	57

LIST OF APPENDICES

		Page
Appendix A:	List of Computer Policy Task Force Members	A-1
Appendix B:	Meetings of the Computer Policy Task Force	B-1
Appendix C:	Work Plan For the Computer Policy Task Force	C-1
Appendix D:	Consultant Reports to CPTF	D-1
Appendix E:	References Distributed to Computer Policy Task Force	E-1
Appendix F:	Survey Instruments	F-1
Appendix G:	Profiles of Computing at Missouri Institutions	G-1
Appendix H:	State-Wide Objectives Assessment Questionnaire Results	H-1
Appendix I:	Alternative Strategies for Computing	I-1

Chapter I

SUMMARY

The formation of the Computer Policy Task Force was a joint initiative by the Missouri Department of Higher Education and the Office of Administration/Division of Electronic Data Processing Coordination. During fiscal year 1978, OA/EDPC initiated a planning process that required each state agency to submit annual EDP plans to OA/EDPC. As a part of this initiative, the Office of Administration requested that the MDHE review all equipment requests from Missouri state colleges and universities and make recommendations on the requests to OA/EDPC. Recognizing this review process should be grounded in a broader perspective for higher education computing in Missouri, involving a state-wide perspective and more institutions than those subject to OA/EDPC review, both agencies agreed to initiate and support a state-wide planning effort. MDHE staff proposed such a study to the Coordinating Board for Higher Education in August 1978, and the Coordinating Board approved the formation of the Computer Policy Task Force and directed that it report back to the Coordinating Board within a year. This report is the result of that initiative.

The Computer Policy Task Force held its first meeting on September 20, 1978. At the initial meeting, Commissioner Bruce Robertson presented the charge to the Task Force: to create an atmosphere of cooperation and resource sharing; to improve the cost effectiveness of computing services; and to identify areas of unmet needs and consider new and/or innovative ways of using computing to meet those needs.

The Task Force met nine times during the 1978-79 academic year to conduct its study of higher education computing in Missouri. During this period the Task Force conducted a comprehensive study of computing in Missouri higher education that included review of existing information when available and conducting five surveys of institutions in the state sector. The Task Force also visited a computer cooperative in Illinois and heard presentations on cooperative computing efforts in three other states.

The Task Force also heard presentations on the results of a national study of higher education computing recently conducted by Dr. John Hamblen, University of Missouri-Rolla, and on the future of computer technology by a representative from the computer industry. Two external consultants with extensive experience in state-wide planning and cooperative computing worked closely with the Task Force throughout the study.

The Study Results

State-supported higher education institutions in Missouri use computing for instruction in computer and information sciences and data processing, for other academic uses, and for administrative data processing. An analysis of seven-year trends in expenditures for computing and in the number of computer installations in Missouri and in the entire U. S. shows that while the number of installations has increased in this state, the amount of expenditures on higher education computing in Missouri have not kept pace with national trends. In addition, a recent study of computer and information manpower needs indicates that Missouri and neighboring states are undersupplied in most computer, information science, and data processing related manpower categories. Further analysis of the number of degree programs, enrollments by program, and number of program graduates indicates that existing higher education programs in computer related areas are not adequate. Expansion of four-year programs in computer and information sciences and two-year programs in data processing may be needed to meet current and forecasted manpower needs.

The surveys of computing in Missouri state-supported higher education institutions revealed a great diversity in the quality and availability of computing resources. The most extensive development of computing resources has taken place in the University of Missouri System, which has an excellent computer network. The regional universities, state colleges, and metropolitan two-year colleges have developed stand-alone computer facilities that meet many of their local computing needs.

Two of the four-year institutions, Northwest and Lincoln, currently have access to the University of Missouri network and can thus exploit the specialized capabilities of that resource. Several of the other institutions in the state, especially Harris-Stowe College and the non-urban community colleges, have not been able to exploit fully the potentials of computing for academic or administrative uses. Several of these institutions currently have no access to computing resources.

General Objectives - Recommended

1. *Missouri higher education institutions should have ready access to computing facilities, personnel and software capable of meeting computing needs and objectives identified in the following areas by each institution as commensurate with their individual missions:*

   a. *academic uses (including instruction and research);*
   b. *library uses;*
   c. *administrative (including financial and student information control systems);*
   d. *public service (including the possibility of providing computing services, on a cost recovery basis, to schools, other colleges and universities, and local, state and federal government agencies).*

2. *Higher education in Missouri should attempt to meet current and anticipated computing needs by as effective and efficient means as possible. Effectiveness refers to providing levels of service generally considered desirable and appropriate and efficiency refers to finding the most economical means possible of providing these services. Effectiveness and efficiency should be considered in tandem since the most economical methods of providing services are not always the most appropriate for the users and therefore can, at times, decrease effectiveness. However, the relative costs*

of different hardware, software, and personnel alternatives must be considered when evaluating possible strategies for achieving state-wide objectives. Measures of effectiveness and efficiency should take into account institutional objectives, user needs, hardware costs, software development costs, and personnel requirements.

3. *The cost of developing computing services, including personnel and other software development costs, should be shared among several institutions whenever this resource-sharing approach can reduce the overall costs of development and maintenance of computing systems and provide for other benefits such as greater standardization.*

Specific Objectives - Recommended

1. *Every student in higher education should have the opportunity to acquire computing skills. This implies more than "computer appreciation" courses which do not include actual computer programming usage.*

2. *Students in noncomputer-science curricula should have access to the computer if it has become a commonly used tool in their particular field of study. This implies the existence of specific types of computing that are needed by the discipline and may require facilities for original programming.*

3. *Students in computer and information science and data processing curricula should have access to sufficient computing resources to assure that as graduates they are adequately prepared to work in computing and information processing positions in industry, government, or education.*

4. *Addition of new degree and certificate programs in computer and information sciences and data processing, as well as expansion of existing programs in these areas, should be a high priority for state-supported institutions that have necessary faculty expertise and sufficient student demand.*

5. *Training should be available to faculty who wish to become familiar with computer applicatons in their disciplines. Such training could include instruction in computer programming, but should not be limited to that, since there are needs to learn computing techniques in the teacher's own discipline--e.g., the use of statistical packages and instructionally-oriented data bases in the social sciences, or the technique of developing computer supported instruction modules as supplements to their traditional instructional practice.*

6. *Technical consulting and other academic support services should be available to faculty computer users at all institutions, either locally or through a central support organization.*

7. *All institutions of higher education should be able to acquire computing capability, not necessarily via an on-campus computer, for both administrative and academic needs.*

8. *All institutions should utilize existing resources for administrative and academic computing when available at other institutions or commerically instead of developing them locally.*

9. *Administrative computing requirements for state-supported higher education in Missouri, including the needs for on-line data base management, systems development and acquisition, and staff training and retention, should be studied and where inadequacies exist, solutions developed on an interinstitutional cooperative basis whenever appropriate.*

10. *The potentials of instructional computing, including of computer-assisted and computer-aided instruction, should be more fully exploited by Missouri higher education. Cooperative approaches to the development of instructional computing should be utilized as appropriate.*

Recommendations

The principle assumption underlying the Task Force recommendations is that computer hardware is not the major obstacle to achieving the state-wide objectives identified above. While there are some hardware deficiencies in the state, in fact some institutions have no computing facilities, these limitations are not as much of an obstacle to achievement of the state-wide objectives as the coordination and personnel training problems facing all institutions in the state. The CPTF survey results indicated that faculty and staff development and training are one key to realizing the potentials of computing in both the academic and administrative areas. Another problem has been the limited computer resource sharing to date among institutions in the state which has resulted from the absence of state-wide cooperative mechanism for planning and development. The Task Force has concluded that these problems face institutions in each sector of Missouri higher education and that solutions can be developed on a cooperative basis.

The best way for institutions to increase the computing resources which support their missions is effectively to demonstrate good faith efforts in support of a facilitating mechanism that will protect both institutional and public interests. This strategy is also the best insurance that together the institutions, rather than the MDHE and/or OA, will be the dominant force in the facilitating organization.

The Computer Policy Task Force has considered the results of the study of computing in state-supported higher education institutions in Missouri and several alternative approaches to meeting current computing needs. Based on this study it has developed the following recommendations to the Coordinating Board of Higher Education (CBHE):

1. *The CBHE create a state-wide higher education computing consortium in Missouri, to be known as the Missouri Center for Higher Education Computing (MoCHEC), that will have as its primary functions:*

a. *To serve as an information clearinghouse for higher education computing. This function may include maintaining listings of computer hardware and software and administrative and academic applications, publishing a newsletter, disseminating information from national computing organizations, and serving as a focal point for Missouri participation in national resource-sharing organizations.*

b. *To facilitate the development and support of academic and administrative computing. This function may include workshops that introduce faculty to computer applications in their disciplines, workshops that concentrate on special administrative applications, and training programs for data-processing personnel.*

c. *To provide a formal voice for higher education computing in the state. This function may include encouraging planning for higher education computing and assessing achievement of state-wide objectives.*

d. *To encourage actively development of appropriate levels of computing resources at all colleges and universities. This may include encouraging interinstitutional cooperation in the development of new computing capabilities at all institutions.*

2. *MoCHEC should be governed by a policy board composed of eleven persons, including seven administrators or faculty from state-supported institutions (two from the University of Missouri, two from the regional universities and Lincoln University, one from the state colleges, and two from the community colleges), two administrators or faculty from the independent sector, the Commissioner of Higher Education or his/her designee, and the Director of OA/EDPC or his/her designee. Institutional*

members of the policy board shall be appointed by the presidents of their respective institutions. The policy board should elect its own officers and appoint such technical advisory committees it considers appropriate.

3. *The MoCHEC policy board should oversee implementation of the CPTF's recommendations for the establishment of MoCHEC and the evaluation of other cooperative opportunities. This implementation process will involve the institutional and governmental representatives in a further participatory process of decisionmaking. Implementation will be an ongoing process of refinement and adaptation of the CPTF recommendations.*

4. *MoCHEC should maintain a small professional staff as described in Chapter VI, an should rely in addition on personnel at Missouri educational institutions or other organizations, as appropriate, for workshops and other training and developmental activities, and thus be able to provide institution access to expertise not always available at the local level.*

5. *The CBHE should direct the commissioner, in cooperation with the MoCHEC policy board, to develop a budget recommendation for MoCHEC for FY 1981 that will provide for staff, space and other necessary expenses. In the interim, the Commissioner should use any available resources to provide for the short term functioning of MoCHEC until regular funding can be secured.*

6. *During its first two years of regular funding, MoCHEC should be supported 100% from state appropriations. In subsequent years, MoCHEC should be supported b ¿a combination of state appropriations, institutional dues, and payments for MoCHEC services. A specific plan in this regard is to be developed by the MoCHEC policy board. This arrangement should ensure ample opportunity for MoCHEC to establish itself before having to depend on satisfied users for support.*

7. *The CBHE request the MoCHEC policy board devise a computer resource-sharing policy, to be endorsed by the CBHE, that achieves the following:*

   a. *Provides access to computing at each higher education institution in Missouri.*

   b. *Develops appropriate computing capacities at state-supported institutions that do not now have computing capabilities. The appropriateness of different hardware arrangements should be explored. Possible hosts for networking include the community colleges which have already developed extensive computing capability, the University of Missouri network, or one or more regional universities. Host centers must be committed to developing the necessary services to support remote users.*

   c. *Provide general access to the unique computing resources of the University of Missouri, or other institutions, providing such access to such resources is cost effective.*

8. *For administrative data processing at state-supported institutions, commercially available systems or systems implemented at other Missouri institutions should be acquired when considered appropriate and beneficial by the purchasing institutions. Purchases should, where possible, be made with provisions for sharing between campuses. Decisions by individual institutions should be based on technical feasibility, economic considerations, and appropriateness of the situation. Shared-purchasing strategies can be explored and implemented by MoCHEC when it is created.*

9. *The CBHE request the MoCHEC policy board to conduct a detailed study of the administrative computing needs of state-supported institutions in Missouri, specifically considering the following topics:*

   a. *the possibilities and cost-effectiveness for the development of compatible information systems at the state-supported institutions.*

   b. *the possibilities and potential for development of specialized services by some institutions.*

   c. *specialized strategies for developing the appropriate administrative systems, including the potentials for resource sharing, at state-supported institutions that have not yet developed such support.*

10. *That the CBHE adopt a policy of encouraging institutions to develop quality instructional programs in data processing and computer and information sciences at the two-year and four-year levels and in computer and information sciences at the master's level. Such programs should be developed in sufficient numbers so as to adequately meet the identified need yet avoid an overbuilt status. In addition, institutions should be encouraged to identify and meet the in-service training needs of industry. Certificate programs designed to meet in-service needs should also be a priority for approval by the Board.*

11. *The CBHE request the MoCHEC policy board to conduct a study of the potentials for improving the uses of computing in undergraduate instruction. The possibilities to be explored will include:*

   a. *creation of a computer-aided instruction or instructional time-sharing center in the state;*

b. identification of special training needs of faculty;

c. identification of areas where existing instructional materials could be used and new materials could be developed;

d. identification of methods and procedures to evaluate the effectiveness of instructional computing applications.

12. The CBHE continue to support the implementation of MP III recommendations that Missouri exploit information storage and processing technologies to improve the services provided by Missouri's libraries, including college and university libraries. In particular, the continued CBHE support for the state-wide catalog data-base project is encouraged.

Conclusion

From its first meeting, the Computer Policy Task Force has approached its work with the diverse perspectives of its several members. On the occasion of the Coordinating Board action establishing the Task Force, one member of that Board remarked that "there is no chauvinism like computer chauvinism." Although that comment suggested prescience of the Task Force's difficult struggle throughout the year of its life, in the end the Task Force is satisfied that it has described objectives and recommendations for Missouri higher education computing which appropriately transcend the individual perspectives of Task Force members. This final report is recommended in total by the Computer Policy Task Force for the positive consideration of the Missouri Coordinating Board for Higher Education and the higher education community.

Chapter II

THE CONTEXT FOR STATE-WIDE COMPUTER PLANNING

Imagine the crisis and concern if the concept of the library--a collection of documents and other information services for the entire academic community--were just emerging for the first time. Matters we now consider standard procedure would loom as questions for careful analysis: Who will have access to the library? How will conflicts be resolved when two people want the same book? At what level should policy be established? How will the library be paid for? Should a per-use charge be made or should it be funded out of overhead? Is NSF or USOE interested? Should there be several specialized libraries or a single central one? Where should the library be located? How should it be administered? Should the college invest in the generation of an indexed catalog of its collection? In what form and to what level of detail? Should the college share with other institutions the burden of operating the library? Or should the college go it alone? What is Harvard doing?

After numerous faculty committees considered these questions, the final plan would likely be so complex and so costly that it would be suggested that the entire project be abandoned or postponed indefinitely; yet the pedagogical value of the library would be so great as to make it absolutely essential to establish one at once.

Computation is a resource as useful and as vital to the intellectual health and operation of the college as the library. Its management, however, is little understood, as suggested by the fanciful analogy above. In an age of intense specialization, the computer is a device of such unique generality that in using it the scientist rubs shoulders with the humanist scholar, the creative artist, the administrator, the bookkeeper, and the growing numbers of students seeking access to it. When services are used this widely, how should they be provided? What other institutions can serve as models? How will the various users, with their conflicting demands and divergent goals, be protected from each other in their struggle for service? (Mosmann, 1973, pp. ix-x)

The responses to these challenges have been as diverse as the institutions in which they originate. Yet there exist other challenges facing institutions and state systems of higher education which may necessitate seeking cooperative rather than individual solutions in this important area. Higher education is necessarily confronted with an increasingly troublesome issue in terms of dealing with inflation. It is especially difficult to keep pace with the increases in productivity associated with economic growth in other segments of the economy. Many areas of institutional costs are clearly out of the control of the institution.

For example, despite substantial conservation measures implemented at most institutions, the total utility bills of higher education institutions have risen quite beyond the general inflationary rate. If utilities costs increase by 15% in a year in which the unrestricted revenue available to the institution from all sources has grown by 10%, it is clear that the utilities budget has necessarily consumed a somewhat larger proportion of the total institutional budget than was previously the case. Thus, the institution must necessarily reduce its support of other areas, largely the academic program, by a commensurate amount.

Another factor which is critical in consideration of institutional costs is the fact that instruction is, of necessity, a labor intensive industry. Despite substantial efforts at large lecture/small discussion modes of instruction, despite technological advances in televised instruction and computer-assisted instruction, it remains true that higher education, in general, has not been able to increase productivity in a manner which would allow postsecondary institutions to match a significant portion of the inflationary component of apparent economic growth. That is, while the higher (inflation plus) wages of an assembly line worker may, from the point of view of the firm, be offset by increased productivity through increasingly automated production systems, there is no productivity increase associated with the relentless, yet legitimate, demands for faculty salary increases to prevent inflationary erosion of their economic status. In fact, pressures mount in which the actual "productivity" in this sense is reduced, via smaller class sizes, in the name of quality.

These difficulties are well known to those involved in higher education, and are not the primary point to be addressed in this report. They are reviewed, however, to provide a context for the suggestion that in those few areas where potential for increased productivity and/or economies of scale do exist, they cannot be overlooked. It is incumbent upon those charged with planning and administering postsecondary education to seek to marshall whatever economies are possible in order to minimize dilution of the support of the academic programs of our institutions. One area

which may hold potential for such economies and/or increased productivity is the area of computing.

THE IMPORTANCE OF COMPUTING IN HIGHER EDUCATION

Academic Computing

The most obvious role of computing in a college or university to the layman is in support of the research function. In fact, the advent of the computer age has revolutionized the scope and method of inquiry in almost all disciplines. It is self-evident that the computer can allow the scientific researcher to analyze extensive data sets and complex systems in ways which are simply not possible through other means. The manual alternatives simply do not exist. It is possibly not quite so evident, however, that the computer is changing the nature of research in nonscientific areas; the computer is increasingly becoming a standard tool of investigation in the humanities, for example. Computers are now used as a means of identifying patterns associated with individual writing style in identifying authorship of documents, or even the period within an author's career when a given manuscript was produced. The social sciences have access to extensive demographic and survey data which can be aggregated in such ways as to produce totally new insights into social behavior and problems, again impossible through manual means. In all disciplines, the advent of the computer has made available to the researcher, on a routine basis, analytic tools which in earlier times merely the successful calculation of which were a sufficient achievement to qualify as a doctoral thesis. Because research is one of the three essential functions of an institution of higher education, the computer is now inextricably tied to that central purpose. In this regard, access to reliable, relevant computing resources is a primary indicator of the quality of research potential at an institution. If we view higher education as having a basic mission in research, as we must, then we must necessarily be concerned about computing resources as a critical vehicle for the pursuit of new knowledge.

Less fully developed, but of growing importance, is the role of computing in instruction. Computers are now being utilized to contribute to the

instructional process as a tool, as a means or mode of instruction, and as an end of instruction. As tools, computers allow students to concentrate on the construct of a problem in the sciences, for example, rather than the arithmetic. In the not too distant past, the scope of a problem set which could be assigned by a professor of physics or dynamics was constrained by the mathematical manipulations they entailed. Now students in such courses routinely conduct their out-of-class problem set assignments at a computer terminal. Clearly the focus is on setting up the problem correctly, reflecting the principles the instructor is seeking to illustrate, without doing the arithmetic which the machines can do.

As a means of instruction, the computer is at an embryonic stage of development. Despite spectacular demonstration projects, notably the PLATO system developed at the University of Illinois, computer-assisted instruction (CAI) is not a widespread practice in higher education. However, in some specific instances CAI has proven an invaluable aid to instruction, not to replace teachers, but to supplement what instructional personnel can do with learning experiences not otherwise available. For example, CAI projects can allow institutions to provide "dry-lab" experiences for students involved in chemistry courses which have all the learning value of real laboratory experiences, but which enable students to conduct a wider range of experiments than would be either feasible or safe if performed in a wet-lab mode. Another area in which CAI has proven very successful is in basic skill development. Basic grammar, writing, reading, and math skills have been successfully taught through what is an adaptation of the old one-room schoolhouse mode: drill and practice. The difference is that the instruction is individualized; the instruction programs are "smart," in that they diagnose an error by type or content and branch through the program to find the appropriate remedial practice exercise. In conducting such elementary drill and practice exercises, the computer has an inexhaustible supply of a rare teaching resource for this kind of instructional problem: patience.

An important aspect of academic computing as an *end* of instruction is the education of computing professionals. The continuing technological advancement of the computer industry places increasing demands on higher education institutions that offer programs that specialize in the training of computer experts. Several levels of training are generally needed by the computing industry, including training programs for system management engineers and project managers, analysts, programmers, hardware specialists, software specialists, and a variety of other specialized technical personnel. These specialized training needs have lead to numerous training programs. In Missouri there are programs at the associate, bachelor's, master's, and doctoral levels. These programs not only increase the overall computing needs of institutions that undertake this type of training, but they also often require the availability of the most up-to-date computer software and hardware if graduates are to be placed successfully. Several Missouri institutions have indicated that as much as 50% of their current nonadministrative computing may be accounted for by this type of use.

A final role of the computer in the academic life of an institution is not yet generally recognized, but will likely become increasingly prominent in the future. Computer technology has enabled us to extend the range of persons' minds and their span of influence in such a manner as to dramatically reshape many aspects of the way society functions. This impact can only be expected to continue and, probably, accelerate. Therefore, increasing numbers of educators believe that some general exposure to computing concepts, not as technician but in principle and through very simple programming tasks, should be a part of the general education experience. Such an experience will enable students to function as more productive citizens upon graduation, with at least a basic understanding of this technological phenomenon that is going to play an increasingly important role in both their personal and professional lives.

Administrative Computing

Administrative uses of computers in higher education have evolved from the early use of unit record equipment, oriented primarily to the accounting

function. Punched-card systems were processed on sorters and accounting machines and printers in an effort to automate accounting procedures in business. This function was easily adaptable to the business operations of an institution of higher education, and, typically, formed the basis of most institutions' first, tentative steps in administrative computing. A second area which followed, usually much later, was student records. Student records were not an important application of computers until another generation of hardware was available which made mass storage and retrieval reasonably stable and efficient. As computers continued to progress in their sophistication and capability, institutions began to add systems which processed student-applicant information to aid in the admissions process. Some institutions began to use computers to devise their schedule of classes, balancing the diverse inputs of expected enrollments, staffing schedules, and room schedules. Institutions then began to process their student registrations using computers, at first with a series of tub files in which each course or seat in a class was represented by an "IBM card," and the deck of cards a student accumulated became his/her class schedule. With the advent of time-sharing and mass on-line storage, the student record and admission data bases have become immediately available to counselors who can use them in admissions counseling, academic advising processes, and, finally, for on-line student registration.

As the leadership of institutions of higher education began to recognize the difference between traditional administrative style and the need for real management in their growing, increasingly complex institutions, they found need for the kind of management information on which to base their decisions similar to that which private sector business had found. Thus, the notion of a management information system (MIS) evolved which enabled persons to access and manipulate data from financial, personnel, and student records into integrated information sets for use in management and planning purposes. At the same time, organizations and agencies such as the Department of Higher Education and the federal government, began to be increasingly aware of the important role of information in the conduct of their responsibilities. As state legislatures became increasingly sophisticated in their understanding of, and thirst for, higher education data the axiom developed that in state higher education,

the price of money is information. Thus, computers have become essential in the myriad external reporting responsibilities of institutions both as a means of communicating what they do, as a means of garnering support, and as a means for responding to increased demands for accountability.

Library

The third class of applications of computers in higher education recognizes the library as, primarily, an information resource. As a repository of information, a library's tasks are to make that information available to its users while preserving it for the future. Computers have been successfully utilized in cataloging, in new title acquisition, and in automated circulation systems, and such systems are in fairly widespread use now. More recently, libraries have begun using computers as a means of accessing shared data bases. The Missouri State Library is in the process of implementing systems which will enable it to inquire directly into several national data base services which will, at a nominal cost, expand the potential of the researcher or other patron who utilizes the services of that library.

The availability of computerized catalogs of library holdings, when each title record includes a series of key words descriptive of the title subject or contents, makes possible the most revolutionary application of computers in libraries, the bibliographic search. Through this facility, the researcher may enter a series of key words which describe a field or subject of interest and retrieve an index of all library resources which address that subject. Through several iterations of increasingly refined key word entries it is possible for the researcher to select down to the most applicable resources, cutting many weeks from the time required for traditional literature searches at the same time that it expands the comprehensive potential of such a search. There is an enormous potential for library automation in higher education, but progress in this area has not often approached that potential.

APPROACHES TO COMPUTING IN HIGHER EDUCATION INSTITUTIONS

There has evolved no single, successful or best model for making computing resources available to a college or university, or even clear choices

among models for institutions of different sizes, complexity, or program mix. However, several classes of organizational patterns have been identified, and useful labels associated with each to facilitate discussion of their several advantages and disadvantages.

The Stand-Alone Computing Center

Probably the most prevalent organizational form for computing in higher education, and the one utilized at most Missouri state-supported institutions to date, is the stand-alone computing center. This center houses a fairly large-scale computer and provides batch and/or time-sharing services to both administrative and academic users. In some institutions, two stand-alone centers have evolved, one providing services to academic users and the other providing services to administrative users. Libraries' applications may be run on either of these centers, depending primarily on the organization of the institution in question, not the logic of the machine and application. The stand-alone computing center provides substantial advantages to institutions and users. As a wholly "owned" resource, considerations of sharing with external persons or units do not occur. Institutionally specific applications can be easily accommodated, and system modifications implemented without concern for their effects on external users. Offsetting these advantages are relatively high costs for the basic computing power required, the necessity to configure the system for the maximum load rather than the typical or average load or demand, and, because of inevitable cost limitations, a restriction in the scope of computer applications available to users.

Centralized/Star Networks

Some institutions and states have utilized an organizational mode which provides a single large computer with institutions or campuses or users gaining access to that computer through remote job entry (RJE) stations. In such a plan, the RJE stations possess no stand-alone computing capability but really serve only as the means of processing input, and producing output. In addition to the RJE stations for batch applications, other users may have terminals for use in time-sharing applications.

This organizational form may be used within a single-institution multi-campus system, such as the University of Missouri, or it may cross institutional lines. For example, Lincoln University now has an RJE station linked via telephone lines to the computing center at the University of Missouri computer network in Columbia.

Star networks have typically been organized as university-centered. That is, a single, large university acquires the necessary computing facility, and then makes that resource available to other users in such a manner as to recover part of its cost, and to seek to utilize its marginal capability over average institutional demand purchased because of the necessity of configuring academic computers for the peak problem. However, not all star networks are university centered. Others have been organized with an independent nucleus of the star. The most notable model is the Triangle Universities Computation Center (TUCC) in North Carolina. Here three large universities, geographically proximate, set up a computer service organization as an independent corporation, jointly owned by the three universities. Initially subsidized by a federal grant, TUCC is now self-supporting, supplying the bulk of the computing requirements at these three institutions. Each institution "purchases" its computing resources from the TUCC, and the pricing is designed so that the center operates on a self-supporting basis.

Joint Resource-Sharing Networks

In a few instances, a unique pattern of computer resource sharing has evolved among large universities. Two or more large institutions, each possessing sizable computer installations, can view neighboring universities and facilities as potential enhancements to their own computing power. By linking their individual computers, with some additional hardware and programming expense, users at each institution can have access to the possibly unique capabilities at the other institutions computer sites. An example is the MERIT computer network formed by linkages among the computers of the University of Michigan, Michigan State University, and Wayne State University. Although such networks are technologically quite possible, they remain rare because few institutions of sufficient size to make the arrangement attractive are

located sufficiently proximate or have solved the organizational problems of access, priority, and funding of such multi-computer networks.

On a national scale, one extraordinary networking activity of this kind has been ARPANET. This network, funded by the Department of Defense, links a number of major university and research center computers across the country. Its operations are quite expensive, but it represents probably the ultimate in inter-institutional cooperation in computing. To the individual researcher, the computer at his/her own campus becomes the link to, in effect, many of the major research computing facilities in the nation. However, the cost to individual campuses are sufficiently large that only major research universities can afford to participate.

Distributed Networks

Some systems have taken a hierarchical approach to the organization of computing resources, organizing their facilities around levels of user requirements. Such networks look similar to the star network described above, with one or more large computers at the center for most large-scale processing requirements. However, instead of the remote centers having only input-output capability, they have their own smaller computer linked to the center facility. Thus, reasonably smaller or less esoteric computing can be done at the local facility, and only those jobs requiring the larger machine are transmitted to it by the remote computer, the remote computer in this instance functioning as an RJE station. The remote computers may themselves be the hub of a subsidiary network of RJE stations and/or time-sharing terminals.

This approach to complex computing requirements of large organizations is labeled a distributed computing network, for obvious reasons. It has many advantages. Most notable among these is that it fits the computer to the specific application, rather than requiring that a computer be configured for the maximum application. That is, the large central computer does not "waste its time" processing relatively low-level jobs which could more economically be processed on smaller machines. Thus, it has more of its time available for the jobs which require its power. At the same time, decentralized users have the reliability and satisfaction

of their own computing capability, while gaining access to a level of computing resource they could not likely afford if they were to operate in the stand-alone mode. Many states have moved to this mode of organization for higher education computing. It is also becoming increasingly common in the profit sector. Computing in large businesses has typically evolved from multiple stand-alone centers to highly centralized, star networks, to distributed networks. The economies are very substantial, but the increase in computing resources available to all participants in the system may probably be even more important than the economy in the long run.

As an example, a regional university might have a computer such as an IBM 370/138. In assessing its future requirements it might conclude that for its own purposes, both administrative and academic, it needed more computing capability and consider acquisition of the next step in that line, a 370/148. However, access to a distributed network would allow an institution to reconsider that choice in terms of the volume of computing requirements at several levels. Thus, it could well conclude that the institution's computing resource requirements could be very adequately met, in fact enhanced, by a smaller local machine, i.e., IBM 370/125, linked to a large central facility such as the University of Missouri's IBM 370/158-AMD 470/V7 system. Even after paying for its use of the central machine, the total costs to the institution could be less, for an improved level of service. Many successful models of such networks exist in higher education today. Northwest Missouri State University now operates in this manner, linking their local DEC 11/70 to the University of Missouri network.

Hybrid Networks

Hybrid networks are possible combining some of the features of any of the organizational plans described above. In fact, few networks conform precisely to any of the generalized descriptions. However, one special form of a distributed network is worthy of special consideration. This form puts at the center of the network not a single large machine, but two or more computers, each with a distinct capability or special strength. As with anything else, when one considers acquisition of a computer one

looks at trade-offs of various features. Just as in a car one considers power or acceleration versus gas mileage, in a computer one may consider the processing efficiency of relatively small time-sharing applications as opposed to large batch-oriented applications. The high energy physics department clearly prefers the latter type of strength because of its extremely large computational requirements for individual problems. The engineering schools, on the other hand, are likely to lean more in favor of time-sharing support, especially time-sharing facilities which support on-line design and simulation, for example. By configuring a network which includes at its core two machines, each having one of these strengths, and by linking them with the remote sites in such a way that any user can have access to either of the core machines, one can optimize service. At the same time, if the base is sufficiently broad, economies of scale may be so great that the savings in hardware requirements at the remote sites will more than cover the additional cost of multiple central computers. It is difficult to calculate the savings effected by this type of network. The origin of this difficulty lies in that most of the economies effected are of the cost-avoidance type. One cannot say just how much each campus would have to spend if it were to rely on a stand-alone computing center to achieve similar computing requirements, but it would seem self-evident that the cost would be substantial. However, of equal or more importance are the tremendously expanded horizons of computing potential available to the users throughout the total system.

Recent advances in computer technology, particularly in the area of mini and micro computers, have driven down the capital costs of improving campus computer capability. At some research universities, faculty have acquired mini computers as a part of foundation- and government-research grants. These new computers increase the potential for distributed networks at the campus and interinstitutional levels, and raise many questions about the economies inherent in the development of networks that rely primarily on large central machines. In one recent study, the researchers observed that as a result of the mini-computer revolution "existing state-wide networking arrangements may prove ultimately to be obsolete and costly" (Heydinger and Norris, 1977, p. 113). The advent and availability of mini and micro computers, along with other recent improvements in

computer technology, are essential factors to consider when formulating state-wide policy regarding higher education computing.

APPROACHES TO COOPERATIVE COMPUTING IN MISSOURI

As noted in the quotation cited in the opening of this chapter, the organizational problems which computing presents to institutions of higher education are complex. Within an institution there are very severe conflicts due to the competing demands of the varied users. Even the types of applications envisioned by each user suggest different approaches to hardware decisions which are, often, irreconcilable in a generally acceptable manner. When one attempts to satisfy the needs of users on more than one campus, the problems increase in a geometric fashion.

Despite substantial barriers to cooperative computing, many states have instituted state-wide plans for computing, and the trend is accelerating. Prior to 1970, state-wide planning for higher educational computing was virtually nonexistent. By 1975, 26 states had initiated or completed state-wide planning activities, many of which led to networking plans (Heydinger and Norris, 1977, p. 34). Some of the earliest of these plans were not successful and were later revised or dropped. Others have been eminently successful, and more recent efforts have benefited from the experience of those that went before. In an EDUCOM-sponsored study of cooperative computing, Missouri was listed as one of 10 states where there was "no planning, no immediate prospects" (Heydinger and Norris, 1977, p. 35).

State-wide planning for higher education computing in Missouri must be considered in context. In Missouri higher education, the computing environments in state-supported institutions vary in their purposes, structure and levels of financial support for the three different categories of Missouri institutions: the University of Missouri system, the other four-year institutions and the two-year institutions.

The University of Missouri system is the only state-supported system offering doctoral degrees and, as a result, the UM campuses maintain more commitment to research than institutions in the other sectors. In addition, two campuses have significant engineering curricula, one campus has a doctoral program in computer science, two campuses have master's programs in computer science, and two campuses have medical schools. As the major land-grant institution, the University of Missouri also administers the bulk of the agricultural experiment and extension programs in the state. Each of these functions requires sophisticated academic computing support. A single governing board oversees the operation of the University of Missouri system. The University of Missouri maintains a well-established centralized computer network. In addition to this centralized computer processing, each campus maintains a computer facility and staff which coordinate local academic and administrative computing. The University of Missouri also has more administrative autonomy than the other state-supported four-year institutions due to its constitutional status. Computer equipment and service acquisitions of the University of Missouri are exempt from review by the Office of Administration.

The other four-year institutions include five regional universities, three state colleges, and Lincoln University. Although each of these institutions has a distinct and unique history, they have some common characteristics. They tend to emphasize undergraduate education in arts and sciences, education and business curricula. Graduate programs offered at the six universities are limited to master's level work. None of these schools has extensive sponsored-research activity. Although none of them offers a graduate program in computer or information science, the majority of Missouri students enrolled in undergraduate level studies in such fields attend one of these schools. Each of these institutions has its own governing board. These institutions are subject to a state law that requires the Office of Administration, Division of Electronic Data Processing Coordination to review and approve all their computing services expenditures. In addition, most purchasing must be processed by the state purchasing office.

The state two-year schools have practically no research computing needs, graduate or undergraduate. Their academic computing requirements result from two-year information processing degree programs and, in a few

instances, the use of computing to enhance instructional programs. There is a heavy administrative computing workload at the large, urban two-year institutions; however, it is virtually identical to that of the four-year schools with similar enrollments. The urban systems (St. Louis Community College and the Metropolitan Community College) each have a single board governing several campuses. There are separate boards at all other two-year schools. The Office of Administration has no authority over computer purchasing decisions made at these institutions.

ORGINS OF PLANNING IN MISSOURI

One of the conclusions most evident in the literature on networks and cooperative computing is that successful efforts have been associated almost exclusively with those projects initiated by the agency having responsibility for state-wide coordination of higher education. Computer planning is apparently not a problem that can be approached "bottom-up," but must be initiated in a "top-down" fashion, (Heydinger and Norris, 1977). However, the second primary indicator of successful efforts is the full and active participation of the institutions and agencies which will, eventually, be part of the cooperative effort.

The formation of the Computer Policy Task Force was a joint initiative by the Department of Higher Education and the Office of Administration, Division of Electronic Data Processing Coordination. During fiscal year 1978, OA/EDPC initiated a planning process that required each state agency to submit annual EDP plans to OA/EDPC. As a part of this initiative, the Office of Administration requested that the MDHE review all equipment requests from Missouri state colleges and universities and make recommendations on the requests to OA/EDPC. Recognizing this review process should be grounded in a broader perspective for higher education computing in Missouri, involving a state-wide perspective and more institutions than those subject to OA/EDPC review, both agencies agreed to initiate and support a state-wide planning effort. MDHE staff proposed such a study to the Coordinating Board for Higher Education in August 1978, and the Coordinating Board approved the formation of the Computer Policy Task Force and directed that it report back to the Coordinating Board within a year. This report is the result of that initiative.

Chapter III

THE COMPUTER POLICY TASK FORCE STUDY OF COMPUTING IN MISSOURI HIGHER EDUCATION

The Coordinating Board for Higher Education authorized establishment of the Computer Policy Task Force in August, 1978. The Computer Policy Task Force held its first meeting on September 20, 1978. At the initial meeting, Commissioner Bruce Robertson presented the charge to the Task Force: to create an atmosphere of cooperation and resource sharing; to improve the cost effectiveness of computing services; and to identify areas of unmet needs and consider new and/or innovative ways of using computing to meet those needs. A list of Task Force members and participant-observers is included as Appendix A.

The Task Force met nine times during the 1978-79 academic year to conduct its study of higher education computing in Missouri. A list of the meeting dates and locations and topics addressed at each meeting are included in Appendix B. As part of the first three meetings, the Task Force developed a problem statement and study plan included as Appendix C.

Consultants

Two consultants worked closely with the Computer Policy Task Force in the design and implementation of the study plan. One of the consultants, Donald M. Norris (Director, Institutional Studies, University of Houston), has expertise in state-wide planning for higher education computing and is coauthor of the principal research monograph on planning for cooperative computing. The other consultant, Louis T. Parker is Director of the North Carolina Educational Computing Network, an organization that has pioneered cooperative approaches to academic computing. The consultants attended Task Force meetings and prepared several special documents outlining policy alternatives for the Task Force to consider. A report detailing some of the consultant recommendations to the Task Force is included as Appendix D. Their final reports to the Task Force have been incorporated into Chapter VI.

In addition to these outside technical consultants, a council of computer center directors from state-supported higher education institutions was created. The council met periodically during the computer study. The chairman of this group served as a Task Force member and the group was consulted on the design of the computer-study survey instruments.

Materials Reviewed by Task Force

The Task Force reviewed a variety of materials on higher education computing, computer technology, cooperative computing, computer networks, information processing, and computer financing. A list of references made available to the Task Force and reviewed by MDHE staff is included as Appendix E.

Presentations to Task Force

As a part of its information gathering process, the Task Force had several presentations by experts in the field of higher education computing. These included:

1. A presentation by Dr. John Hamblen, Chairman of Computer Science at the University of Missouri-Rolla, on the trends in expenditures on higher education computing in Missouri compared to national trends. Dr. Hamblen had completed the initial analysis of the results from the Fourth Inventory of Computing in Higher Education, a national study supported by the National Science Foundation.

2. A tour of the Mid-Illinois' Cooperative Computing (MICC) Facility at Southern Illinois University in Edwardsville, Illinois, accompanied by a presentation by Walter Parrill, MICC Executive Director. The presentation, entitled "MICC: Past, Present, and Future," considered the reasons for forming the cooperative computing network in Illinois, the present organization and funding of this enterprise, and its future prospects.

3. A panel of Directors of state-wide computing facilities made a presentation at the fourth Task Force meeting. The panelists included: Dale LaFrenz, Director of Instructional Services, Minnesota Educational Computing Consortium (MECC); Chuck Shomper, Director, West Virginia Network for Educational Computing (WVNET); and Louis T. Parker, Director, North Carolina Educational Computing Services (NCECS). The panel and discussion focused on how cooperative computing has developed in these three states.

4. The fifth meeting included a presentation by Steven Adler, IBM Corporation, on the future of computing technology in higher education. Mr. Adler considered some of the future trends in higher education computing that might influence state-wide planning during the next decade.

Computer Surveys

The Task Force conducted several surveys concerning computing in Missouri's state-supported institutions. The Task Force, with the assistance of the two external consultants and the Computer Center Directors' Council, and with MDHE staff support, developed, administered and analyzed five questionnaires. Copies of the survey instruments are included in Appendix F. These included:

1. State-Wide Computing Objective Assessment Questionnaire (completed by chief executive officers), designed to solicit opinions concerning the appropriateness of possible state-wide objectives developed by the Task Force.

2. Academic Computing Survey For Chief Academic Administrators, which was designed to assess the extent and nature of academic computing at Missouri state institutions.

3. Student Access to Computing Resources for Computer Center Directors, designed to assess the quality of academic computing facilities.

4. Management Systems Development Survey, completed by directors of administrative data processing, designed to assess the extent and applicability of information system automation.

5. Update of Computer Facilities Inventory, Form 1 of the National Study of Computing Facilities as conducted by Dr. John Hamblen, Chairman, University of Missouri-Rolla Computer Science Department.

Survey Results

The results of these five surveys have been analyzed by MDHE staff and the Task Force and are largely embodied in this report. A profile of computing at each state-supported institution is included as Appendix G. A detailed analysis of the responses to the objectives survey is included as Appendix H.

Chapter IV

COMPUTING IN MISSOURI HIGHER EDUCATION: THE STUDY RESULTS

Computing is integral to higher education in Missouri. The institutions train much of the manpower needed in the information processing industries throughout the state, of course. but computing is integrated into other institutional functions as well. It is used to enhance and improve instructional processes in many disciplines other than computer science. Computing is also necessary to conduct research in many academic fields, such as engineering and physics, and can enhance the quality of research in most others, even in the humanities where computers can be used as a research and cataloguing tool. In addition, computing is used as an information processing tool to improve the efficiency of college and university management. State-supported institutions in Missouri use computing for each of these purposes.

There is a great diversity in the extent to which computing has been used by individual higher education institutions in Missouri, however. Appendix G gives details on the computer facilities, expenditures on computing, and uses of computing for academic and administrative purposes at each state-supported institution. In some areas, particularly in the development of an extensive centralized computer network in the University of Missouri system, the institutions have done an excellent job integrating computing into educational and administrative activities. Other institutions in the state, particularly the regional universities and the urban community college systems, have done well to develop computing facilities with both academic and administrative applications when their overall level of financial support for computing has not kept pace with other higher education institutions in the United States. Finally, several institutions in the state, particularly the single-campus two-year institutions, have not been able to utilize the potentials of

computers due to a lack of resources that could be used to develop stand-alone computing facilities, nor have these institutions had access to a state-wide educational computing network.

There is, in short, a diverse and complex situation in Missouri. This chapter summarizes the results of the study of higher education computing in Missouri. Two types of information were used. First, previously existing information on Missouri computing was utilized whenever possible. Second, results from three of the computer survey questionnaires are summarized in this chapter as well.

The Hamblen Study

Dr. John Hamblen, chairman of Computer Science at UMR, has recently completed the analysis of the Fourth Inventory of Computers in Higher Education (FICHE). Basic information on computer facilities and expenditures for Missouri institutions and for the total United States was presented to the Computer Policy Task Force at its initial meeting. The response rate for Missouri institutions on the FICHE study were higher than the national response rate, Table 1, with 94% of the state-supported institutions responding, compared to only 58% of the state-supported institutions nationally.

TABLE 1. RESPONSE TO FICHE SURVEY FOR MISSOURI

	Response Rates			
	1969-70		1976-77	
Missouri - State-Supported	(20/27)	.74	(29/31)	.94
Missouri - Independent	(37/48)	.77	(42/53)	.79
Total Missouri	(57/75)	.76	(71/84)	.85
Total U. S.	(2103/2807)	.75	(1822/3136)	.58

In 1969-70, 32 Missouri institutions reported 44 installations.
In 1976-77, 47 Missouri institutions reported 54 installations.

Source: FICHE Study, 1978

The FICHE study provides comparative data for 1969-70 and 1976-77 for Missouri institutions and for the total U. S. The number of computer installations at Missouri higher education institutions increased from 44 to 54 during this seven-year period. The use of off-campus computing facilities by higher education institutions also increased slightly for state-supported institutions in Missouri, from 1 to 5, while it decreased for independent sector institutions in the state and for the U. S. as a whole (see Table 2).

TABLE 2. MISSOURI USE OF OFF-CAMPUS COMPUTING FACILITIES

	1969-70*	1976-77*	% Increase (Decrease)
Missouri State-Supported	1	5	500
Coop-Non Profit	0	0	0
College or University	1	3	300
Commercial	0	2	--
Missouri Independent	5	2	(60)
Coop-Non Profit	3	0	--
College or University	3	1	(67)
Commercial	5	1	(80)
Missouri Total	7	9	29
Coop-Non Profit	3	0	--
College or University	5	0	0
Commercial	5	4	(20)
U. S. Total	496	329	(34)**
Coop-Non Profit	76*	77*	1
College or University	410*	164*	(60)
Commercial	294*	88*	(70)

**I.E. In 1976-77, 34% fewer institutions paid for off-campus computer facilities.
*Detail numbers may not be comparable.

Source: FICHE Study, 1978

The number of installations using interactive computing and remote computing also increased in Missouri during the seven year period (Table 3). Seventeen of the state-supported installations in Missouri reported using

remote facilities in 1976-77, which is over half of the state-supported campuses in Missouri. This indicates that cooperative approaches to computing are already being used in Missouri.

The total number of employees in college and university computer centers in Missouri remained relatively constant during the seven-year period, increasing by 6% in full-time employees and decreasing by 8% in part-time employees (Table 4). Nationally, the number of computer center employees increased at a much higher rate: 39% for full-time employees and 17% for part-time employees. There are a couple of possible explanations for the slow growth in total number of employees at these centers during a period when the number of computer centers in Missouri increased. One is that in spite of the growth in the number of computer installations, the financing of computing in Missouri has not kept pace with national trends. Another possible explanation is that trained persons have not always been available. The FICHE study provides data on both trends.

Expenditures on computing increased by 68% in state-supported institutions in Missouri, compared to a national increase of 110% in expenditures on computing expenditures during this same period (see Table 5). Income for computing from federal sources decreased in Missouri, by 21%, and in the U. S., by 14%, during the seven-year period. Income from institutional sources did not increase as rapidly in Missouri, as it did in the U. S. as a whole; there was a 69% increase in Missouri compared to a 135% increase in income from institutional sources for the total U. S. Thus the financing of computing in Missouri higher education has not kept pace with national trends. However, because funding allocation within institutional budgets are determined locally, this conclusion reflects the results of both total funds available and institutional priorities.

The manpower training needs for the information processing industry have been increasing faster than colleges and universities have been able to respond, both nationally and in Missouri. The FICHE study also provides detailed information on manpower needs in Missouri and other states. Regarding the need for trained manpower in the computer field Hamblen points out:

TABLE 3. MISSOURI ESTIMATED NUMBERS OF INSTALLATIONS WHICH USE INTERACTIVE AND REMOTE COMPUTING

	Interactive Computing			Remote Computing		
	1969-70	1976-77	% Increase (Decrease)	1969-70	1976-77	% Increase (Decrease)
Missouri State-Supported	3	13	333	3	17	466
Missouri Independent	3	4	33	5	6	20
Missouri Total	6 (9%)*	17 (28%)*	183	8 (14%)*	23 (39%)*	188
U. S. Total	460 (21%)*	1,134 (41%)*	146	671 (30%)*	893 (33%)*	33

*Percent of installations using

Source: FICHE Study, 1978

TABLE 4. MISSOURI ESTIMATED NUMBER OF EMPLOYEES IN COMPUTER CENTERS

	1969-70		1976-77		% Increase - (Decrease)	
	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time
Missouri State-Supported	375	250	397	230	6	(8)
Missouri Independent	134	92	146	77	9	(16)
Missouri Total	509	342	543	307	7	(10)
U. S. Total	19,466	9,849	27,126	11,501	39	17

Source: FICHE Study, 1978

TABLE 5. MISSOURI ESTIMATED EXPENDITURES FOR COMPUTING AND ESTIMATED FUNDS FOR COMPUTING, BY SOURCE (DIRECT COSTS ONLY)

	Estimated Expenditures			Estimated Funds, By Source		
	1969-70 (in 000's)	1976-77 (in 000's)	% Increase	1969-70 (in 000's)	1976-77 (in 000's)	% Increase (Decrease)
Missouri State-Supported	$ 8,165	$ 13,677	68			
Institutions				$ 7,453	$ 12,613	69
Federal				624	496	(21)
Other				509	531	4
Missouri Independent	2,434	3,807	56			
Institutions				1,589	3,520	122
Federal				514	247	(52)
Other				331	80	(76)
Missouri Total	10,599	17,484	65			
Institutions				9,042	16,133	78
Federal				1,138	743	(35)
Other				840	621	(26)
U. S. Total	$393,300	$826,000	110			
Institutions				276,000	650,000	135
Federal				66,000	57,000	(14)
Other				$51,400	$84,800	65

Source: FICHE Study, 1978

> In the 1978-79 Occupational Outlook Handbook published by the Bureau of Labor Statistics, it was reported that there were over 160,000 systems analysts in 1976, over 230,000 programmers and over 280,000 operators. The projections for 1985 are also presented and are 200,000 for systems analysts, 280,000 for programmers and 340,000 for operators. Some of the differences result from definitions. I would guess that some of what I call systems programmers are counted by BLS as programmers and others as systems analysts since no such category as systems programmers appears in BLS publications referred to above.
>
> Management personnel are most likely to be counted under "Managers" in the BLS classifications and on page 98 of the 1978-79 Handbook there is an indication that what I call other operating personnel (excluding card punch operators) are included under Office Machine Operators. In particular, operators of tabulating machines and related equipment, where such equipment is an integral part of a computer installation, would fall under my classification of "other operating personnel."
>
> In BLS Bulletin 1673, it was estimated that there would be 120,000 computers in use by 1980 and that the number of process computers would reach about 17,000. I believe that the 120,000 figure is conservative, depending upon one's definition of a computer. In the same publication it was estimated that for the period 1968-80 there would be annual openings for 23,000 programmers, 27,000 systems analysts and 20,400 operators, or a total of 70,400 in just these three classifications. Since these three categories account for about two-thirds of my total estimates, extrapolation of the 70,400 figure gives about 105,000 annual openings per year. This number compares very well under the circumstances with my estimated need of 116,000 per year. (Hamblen, 1979, p. 19)*

Regarding adequacy of training programs to meet this demand, he observes: "Large numbers of personnel have been able to enter the computer manpower pool in the past with little training. The proprietary schools had a 'heyday'. Only the best and largest have survived. Large amounts of federal and state funds were poured into the vocational and 2-year programs" (p.23). He advocates that institutions study the state and regional manpower needs when planning postsecondary curricula. Regarding bachelor's-level programs he recommends:

> The institutions involved and wanting to get involved in bachelor's-level programs in computer science, data processing, etc., should study state and regional needs, strengthen, broaden and expand existing 4-year programs, delete other weak programs and initiate programs where state and regional need is indicated. (p. 23)

*Hamblen, J. W. Computer Manpower-Supply and Demand - By States, 1979. St. James, MO: Information Systems Consultants, 1979.

His recommendation for master's-level programs is similar:

> My recommendation for institutions offering or wanting to offer master's-level programs in computer science, information systems, etc., is still the same. Study state and regional needs and then full speed ahead. (p. 23)

The manpower needs for Missouri indicate that more training programs may be needed at the bachelor's, master's and doctoral levels. Table 6 from the Hamblen study indicates that although training at the two-year and vocational level is adequate to meet the demand, manpower needs in Missouri at the four-year and master's degree level are drastically insufficient. The production of four-year graduates was almost 1,000 people below the estimated need in 1976-77, while the production of master's-level graduates was 700 below the 1976-77 need. At the two-year level, according to the Hamblen data, production was in excess of need. However, most of this production of two-year graduates was in the proprietary sector, as indicated by the following information on degree programs and enrollment and degree information.

Computer Science and Data Processing Programs

Missouri higher education institutions do not currently have adequate training programs in computer science and data processing. A listing of institutions offering programs in computer and information sciences and in data processing technologies is included in Tables 7 and 8. There are seventeen bachelor's-level programs in computer and information sciences, four master's-level programs, and two doctoral programs. There are also twenty certificate- or associate-level programs.

During the past academic year, 1977-78, a total of 186 associate degrees and certificates were awarded by these Data Processing Technologies programs (Table 9). The headcount enrollment in the two-year and certificate programs during the fall of 1978 was 1,510. The number of degrees and certificates awarded at the two-year level by the higher education institutions in the state, as contrasted to the proprietary sector institutions, is well below the 607 estimated annual manpower needs. The high enrollments in data processing relative to the number of degrees awarded, suggests that people enrolled in these programs may be finding employment before they have completed their programs.

TABLE 6. ESTIMATED COMPUTER MANPOWER NEEDS AND ESTIMATED PRODUCTION FOR 1976-77 BY POSTSECONDARY INSTITUTIONS BY STATES

State	PS VOC and 2-year		4-year		Master's		Doctorate	
	Need	Production	Need	Production	Need	Production	Need	Production
Alabama	396	196	815	86	512	17	20	0
Alaska	26	56	54	0	34	0	1	0
Arizona	659	632	1359	163	854	77	33	9
Arkansas	211	42	435	55	273	14	10	0
California	2163	6483	4457	810	2801	464	107	119
Colorado	316	413	652	52	410	34	16	3
Connecticut	369	175	761	45	478	26	18	0
Delaware	79	62	163	0	102	0	4	0
District of Col.	158	53	326	0	205	224	8	0
Florida	607	1193	1250	272	786	24	30	2
Georgia	475	374	978	160	615	124	24	9
Hawaii	106	125	217	0	137	0	5	0
Idaho	79	17	163	26	102	0	4	0
Illinois	1372	1541	2826	678	1176	175	68	58
Indiana	686	428	1413	298	888	114	34	9
Iowa	633	454	1304	255	820	48	31	19
Kansas	448	229	924	187	581	83	22	5
Kentucky	343	133	707	119	444	17	17	0
Louisiana	316	94	652	213	410	3	16	0
Maine	185	15	381	7	239	3	9	0
Maryland	528	1062	1087	323	683	83	26	19
Massachusetts	1161	293	2391	224	1503	103	58	21
Michigan	1134	1370	2337	310	1469	115	56	9
Minnesota	659	153	1359	404	854	120	33	14
Mississippi	290	206	598	162	376	28	14	0
Missouri	607	786	1250	294	786	69	30	7
Montana	158	61	326	17	205	0	8	0
Nebraska	211	114	435	26	273	0	10	0
Nevada	79	55	163	0	102	0	4	0
New Hampshire	132	12	272	29	171	0	7	0
New Jersey	607	677	1250	255	786	124	30	0
New Mexico	53	7	109	14	68	5	3	0
New York	2453	1736	5055	834	3176	267	122	0

TABLE 6. (CONTINUED)

State	PS VOC and 2-year		4-year		Master's		Doctorate	
	Need	Production	Need	Production	Need	Production	Need	Production
North Carolina	712	711	1468	136	922	26	35	3
North Dakota	106	82	217	58	137	2	5	0
Ohio	950	630	1957	710	1230	215	47	14
Oklahoma	343	478	707	19	444	17	17	0
Oregon	369	327	761	65	478	33	18	0
Pennsylvania	1319	895	2718	664	1708	95	65	14
Rhode Island	132	95	272	50	171	24	7	2
South Carolina	422	215	870	14	546	0	21	0
South Dakota	79	36	163	19	102	0	4	0
Tennessee	448	550	924	148	581	5	22	3
Texas	1134	1737	2337	540	1469	138	56	19
Utah	106	32	217	48	137	0	5	0
Vermont	106	0	217	0	137	0	5	0
Virginia	686	499	1413	225	888	64	34	0
Washington	580	455	1196	89	751	33	29	3
West Virginia	211	126	435	79	273	0	10	0
Wisconsin	659	1045	1359	239	854	144	33	9
Wyoming	79	58	163	17	102	0	4	0
Service Schools	79	0	163	36	102	0	4	0
Canal Zone	0	0	0	0	0	0	0	0
Guam	0	0	0	0	0	0	0	0
Puerto Rico	106	55	217	21	137	0	5	0
Virgin Islands	0	0	0	0	0	0	0	0
American Samoa	0	0	0	0	0	0	0	0

Source: Hamblen, J. W. Computer Manpower -- Supply and Demand By States, 1979. St. James, MO: Information Consultants, 1979

TABLE 7. LISTING OF PROGRAMS IN COMPUTER AND INFORMATION SCIENCES

		Degree Levels B	M	I	D	P
0701	Computer and information sciences, general					
	University of Missouri Columbia		M			
	University of Missouri, Rolla	B	M		D	
	Central Missouri State University	B				
	Northwest Missouri State University	B				
	Southeast Missouri State University	B				
	Southwest Missouri State University	B				
	Missouri Western State College	B				
	Washington University	B	M		D	
	Fontbonne College	B				
	Rockhurst College	B				
	Westminster College	B				
	William Woods College	B				
0702	Information sciences and systems					
	Maryville College	B				
0703	Data processing					
	Central Missouri State University	B				
	Missouri Western State College	B				
	Washington University	B	M			
	Avila College	B				
	Southwest Missouri State University	B				
0704	Computer programming	NONE				
0705	Systems analysis	NONE				
0799	Other					
	Systems management					
	Rockhurst College	B				

TABLE 8. LISTING OF PROGRAMS IN DATA PROCESSING TECHNOLOGIES

		Degree Levels C*	C1	C2	A
5101	Data processing technologies, general				
	Lincoln University				A
	Missouri Western State College				A
	St. Louis University		C1		
	Washington University			C2	
	Avila College				A
	Drury College				A
	Jefferson College		C1		A
	MCCD-Longview Community College				A
	MCCD-Penn Valley Community College				A
	St. Louis Community College at Florissant Valley		C1		A
	St. Louis Community College at Forest Park		C1		A
	St. Louis Community College at Meramec				A
	East Central Junior College		C1		A
5102	Keypunch operator and other input preparation technologies				
	Missouri Southern State College				A
	Moberly Area Junior College		C1		A
5103	Computer programmer technologies				
	Central Missouri State University				A
	Southeast Missouri State University				A
	Missouri Southern State College				A
	Missouri Western State College				A
	Moberly Area Junior College				A
5104	Computer operator and peripheral equipment operation technologies	NONE			
5105	Data processing equipment maintenance technologies	NONE			
5199	Other				
	Data processing				
	Northwest Missouri State University			C2	

TABLE 9. HEADCOUNT ENROLLMENT AND DEGREES AND OTHER FORMAL AWARDS CONFERRED IN 5100, DATA PROCESSING TECHNOLOGIES

Discipline / Institution	Fall 1978 Headcount Enrollment	Degrees Conferred Between July 1, 1977 and June 30, 1978 Associate	Certificate
5101 Data processing technologies, general			
Lincoln	34	--	--
Western	16	3	--
East Central*	NA	NA	NA
Jefferson	15	--	--
Longview	96	18	--
Penn Valley	228	18	--
Florissant Valley	459	30	6
Forest Park	112	23	8
Meramec	209	25	--
St. Louis	0	--	--
Washington	0	--	--
Avila	NR	--	--
Drury**	38	14	--
TOTAL	1,207	131	14
5102 Keypunch operator and other input preparation technologies			
Southern	31	--	--
Moberly	10	--	--
TOTAL	41	--	--
5103 Computer programmer technologies			
Central	18	2	--
Southern	101	17	--
Western	8	0	--
Southeast	51	21	--
Moberly	25	1	--
TOTAL	203	41	--
5104 Computer operator and peripheral equipment operation technologies			
None			
5105 Data processing equipment maintenance technologies			
None			
5199 Other			
Accounting and Data Processing			
Northwest	59	--	--
GRAND TOTAL	1,510	172	14

* East Central's program in data processing was approved in 1979.
** Drury's enrollment is for fall 1977.

Sources: Enrollment: MDHE 10-2, Enrollment in Programs of Less than Four Years
Degrees: NCES 2300-2.1, Degrees and Other Formal Awards Conferred Between July 1, 1977 and June 30, 1978

At the baccalaureate and graduate levels, this situation is even more troublesome. The state-wide headcount enrollment in four-year programs in computer and information sciences was 530 during the fall 1978. The number of four-year degrees awarded during the 1977-78 academic year was 220 (see Table 10). This is well below the estimated annual manpower need of 1,250 estimated by the Hamblen study. The story is similar at the master's and doctoral levels. Headcount enrollments in fall 1978 were 134, and degrees awarded in 1977-78 were 51 (48 at master's, 3 doctorates), while the projected need is 786 master's level graduates and 30 doctoral-level graduates.

For some academic program areas a deficiency in manpower supply in one state can be offset by training programs in neighboring states. In the computer industry this is not the case for Missouri. A closer examination of the state-by-state manpower needs and production forecasts (Table 6) show that neighboring states--Arkansas, Kansas, Nebraska, Oklahoma, Illinois, Iowa, and Tennessee--all face a similar situation. There is currently not enough trained manpower to meet the demands of the computer and information processing industries in the state of Missouri or in states adjacent to it.

Quality of Computing Facilities

Two of the survey instruments administered as part of the Computer Policy Task Force study of computing in Missouri state-supported institutions dealt with academic computing. One, which dealt with the quality of instructional computing facilities, was completed by computer center directors; the other questioned academic administrators about the current and potential uses of academic computing in their institutions. The former is summarized first.

Table 11 presents the scores for student access to computer resources. The first nine items on the table are composite scores on a quality ranking designed by Charles Mosmann. Mosmann suggests that caution be used to interpret the results of these raw scores:

TABLE 10. HEADCOUNT ENROLLMENT AND DEGREES CONFERRED IN 0700, COMPUTER AND INFORMATION SCIENCES

Discipline / Institution	Fall 1978 Headcount Enrollment		Degrees Conferred Between July 1, 1977, and June 30, 1978		
	UD	Grad.	Bachelor	Master	Doctor
0701 Computer and information sciences, general					
UMC	2	38	--	1	--
UMR	108	49	59	28	2
Central	31	--	11	--	--
Western	19	--	--	--	--
Northwest	9	--	7	--	--
Southeast	138	--	41	--	--
Southwest*	NA	NA	NA	NA	NA
Washington	40	47	24	6	1
Fontbonne	0	--	0	--	--
TOTAL	347	134	169	35	3
0702 Information sciences and systems					
Maryville	7	--	--	--	--
Rockhurst	--	--	--	--	--
Westminster	--	--	--	--	--
William Woods	--	--	--	--	--
TOTAL	7	--	--	--	--
0703 Data processing					
Central	66	--	17	--	--
Western	19	--	8	--	--
Southwest	91	--	27	--	--
Washington	--	--	14	13	--
Avila	--	--	7	--	--
TOTAL	176	--	46	13	--
0704 Computer programming					
None					
0705 Systems analysis					
None					
0799 Other					
Systems management					
Rockhurst	--	--	5	--	--
GRAND TOTAL	530	134	220	48	3

*In 1979 Southwest gained approval for a bachelor's program in computer and information sciences.

Sources: Enrollment: MDHE 10-1, Upper Division and Graduate Enrollment by HEGIS Discipline Specialty, fall 1978
Degree: NCES 2300-2.1, Degrees and Other Formal Awards Conferred Between July 1, 1977, and June 30, 1978

> Most questionnaires dealing with educational computing treat only its quantitative aspects: how much computing do students get? Questions having to do with how good the computing is are ignored: not because they are unimportant but because they are so hard to formulate. This questionnaire is different. It is intended to help you assess the quality of computing services provided for students.
>
> It is designed in the form of a self-assessment questionnaire, with points given for questions that can be answered affirmatively. However, no key is given for what constitutes a 'good' score or what different numerical scores mean. Further, you may feel that some of the points are given for very unimportant aspects, while other important functions are undervalued or ignored altogether. Any attempt to reduce quality to a numerical score is bound to be based on one set of views about what is important and to sound biased from many other points of view. It may be, though, that the exercise of completing the questionnaire itself may give you some insight into your performance. (Mosmann, 1977, p. 42)*

The scores on each scale, except red tape, were higher for the University of Missouri than for the two-year or other four-year institutions; scores were also higher at the four-year institutions than at the two-year institutions. In a few instances, these differences were statistically significant. This general finding, that the University of Missouri has better student access to computing than the other four-year institutions and the two-year institutions, is consistent with UM's high ratings on meeting state-wide computing objectives (see discussion in Appendix H).

Computer Center Directors were also asked to estimate the percentages of students who used computing and who could do some programming. The University had a higher percentage of users and programmers than the other two segments. These differences were also statistically significant.

This data provides an indicator of the quality of the computing resources available to students. The average scores for each sector do not tell the entire story, however, since there is often a wide variation in the scores within each sector.

*Evaluating Instructional Computing: Measuring Needs and Resources for Computing in Higher Education, Princeton, N.J.: EDUCOM, 1977.

TABLE 11. STUDENT ACCESS TO COMPUTING RESOURCES

	All Institutions	U.M.	Four-year	Two-year	Significance
Computer Hardware Score	10.7	16.8	12.8	7.3	**
Unit Record Equipment Score	3.4	5.3	3.8	2.6	
Terminals Access Score	4.8	7.5	5.6	3.3	
Software & Language Score	8.0	16.5	9.5	4.3	**
Documentation Score	4.4	9.5	6.0	1.7	**
Consultation & Advise Score	5.5	7.0	6.6	4.3	
Convenience Score	4.8	7.3	5.8	3.2	*
Red Tape Score	5.6	7.0	7.1	4.4	
Percent Students Use Computer	19.8%	40.0%	30.9%	7.4%	*
Percent Students Program	13.2%	35.0%	18.5%	4.2%	*

Source: Computer Policy Task Force, Student Access to Computing Resources Survey, 1979

* Significant difference at .05 level using ANOVA test of significance.

** Significant difference at .01 level using ANOVA test of significance.

Computer hardware score: provides a measure of the quality of equipment available at the institution. A score of 20 yes responses is possible. The range of responses for the UM campuses was between 13 and 19, for the other four-year institutions scores ranged between 7 and 19 (Harris-Stowe, which does not have academic computing facilities, did not respond on this questionnaire) and for two-year institutions the score ranged between 0 and 15. Three of the two-year institutions had 0 on the computing hardware score (this does not include State Fair Community College, which did not respond on this instrument).

Unit Record Equipment Score: provides a measure of availability of keypunch and sorter equipment to students. A score of seven was possible. The UM campuses had a range between 3 and 7, the other four-year institutions between 2 and 7, and the two-year institutions between 0 and 6. Four of the two-year campuses had zero scores.

Terminal Access Score: provides a measure of the availability to students of hard-copy and CRT terminals. Seventeen is the highest possible score. The UM campus ranged between 0 and 16, the other four-year campuses between 0 and 13, and the two-year campuses between 0 and 10. One UM campus, two four-year campuses, and six four-year campus had a score of zero.

Software and Language Score: provides a measure of the availability of programming languages and statistical and other software packages. Highest possible score is 17. The University of Missouri campuses scored 16 and 17, the other four-year campuses scored between 4 and 17, and the two-year campuses scored between 0 and 9. Three of the two-year campuses had a score of zero.

Documentation Score: provides a measure of availability of documentation to campus systems. The highest possible score is 12. The UM campuses ranged between 7 and 12, the other four-year campuses between 0 and 12, and the two-year campuses between 0 and 5. One of the four-year campuses and four of the two-year campuses had a score of zero.

Consultation and Advice Score: provides a measure of the availability of consultation and advice on computing services. Eleven is the highest possible score. Scores ranged between 0 and 11 at the UM and other four-year campuses, and between 0 and 7 at the two-year campuses. Three two-year campuses, one University campus and one four-year campus scored zero.

Convenience Score: provides a measure of access and availability of computing facilities. The highest possible score was 10. The UM campuses ranged between 6 and 9, the other four-year campuses between 1 and 9, and the two-year campuses between 0 and 7. Four of the two-year campuses had a score of zero.

The quality and availability of computer facilities vary for the public higher education institutions in Missouri. The variation between segments is significant: the UM campuses have better facilities and access than the other four-year institutions which have better facilities and access than the two-year institutions.

There is also variation within each segment on the quality of facilities available to students. For the University of Missouri, students at UMR and UMC seem to have access to higher quality computer facilities than students at UMKC and UMSL. At the other four-year institutions Northwest University scored higher on these access measures than any of the other institutions. In the two-year sector, the campuses of the St. Louis and Metropolitan Community College systems have the highest quality facilities with the best access, while remaining two-year campuses have modest facilities at best, and several have no computing facilities.

Academic Computing Survey

One of the survey instruments questioned the chief academic administrators about the use of academic computing at their campus. One portion of the questionnaire asked for estimates of percentages of students who used computing. Tables 12 through 14 present results of the portion of this questionnaire that asked for percentage estimates of

TABLE 12. COMPUTING SKILL LEVEL OF STUDENTS

	Should					Current				
	All Inst.	Univ. of Mo.	Four-year	Two-year	Sig.	All Inst.	Univ. of Mo.	Four-year	Two-year	Sig.
Pct. No Capability	24.9%	5.0%	13.6%	36.8%		64.2%	42.5%	56.0%	73.7%	
Pct. General Awareness	26.9	22.5	17.7	34.3		9.0	7.5	13.7	6.0	
Pct. Indirect Use	16.4	7.5	21.9	14.4		4.6	5.0	8.1	2.0	*
Pct. Elem. Programming	15.0	12.5	27.7	6.6	*	9.7	26.5	13.1	4.0	*
Pct. Inter. Programming	10.8	26.5	13.1	6.1	*	4.7	13.5	5.6	2.3	*
Pct. Advanced Programming	5.0	11.0	6.0	2.9	*	2.2	5.0	2.5	1.4	

Source: Computer Policy Task Force, Academic Computing Survey for Academic Administrators, 1979
* Significant difference at .05 level using ANOVA test of significance

TABLE 13. ACCESS TO COMPUTING FOR INSTRUCTION

	Should					Current				
	All Inst.	Univ. of Mo.	Four-year	Two-year	Sig.	All Inst.	Univ. of Mo.	Four-year	Two-year	Sig.
Pct. No Computer Use	38.4%	37.5%	27.9%	46.8%		71.2%	50.0%	66.3%	80.0%	
Pct. Occasional Access	34.6	20.0	35.0	37.6		11.6	13.0	18.9	5.7	*
Pct. Frequent Access	18.4	26.5	25.0	11.6		7.6	27.0	9.1	2.1	*
Pct. Continuous Access	8.6	16.0	12.1	4.1		3.9	10.0	5.6	1.3	

Source: Computer Policy Task Force, Academic Computing Survey For Academic Administrators, 1979
* Significant difference at .05 level using ANOVA test of signficance

TABLE 14. STUDENT RESEARCH USES OF COMPUTING

	Should					Current				
	All Inst.	Univ. of Mo.	Four-year	Two-year	Sig.	All Inst.	Univ. of Mo.	Four-year	Two-year	Sig.
Pct. No Research Use	56.0%	50.0%	55.0%	58.0%		70.0%	64.5%	86.7%	57.8%	
Pct. Minor Use	23.7	12.5	24.2	25.9		12.7	5.0	6.9	19.0	
Pct. Considerable Use	9.1	16.5	13.3	4.7		2.6	10.0	3.6	0.2	
Pct. Major Research Use	3.3	11.0	4.2	1.0	*	1.8	10.0	1.6	0.2	*
Pct. Central to Research	2.1	10.0	2.5	0.1	*	1.6	10.0	1.1	0.1	*

Source: Computer Policy Task Force, Academic Computing Survey for Academic Administrators, 1979
* Signficant difference at .05 level using ANOVA test of signficance

current and desired student computer use. In general, the same differentiated pattern observed in the responses to the other instruments was evident in the response to this questionnaire. Note that these percentage estimates are not weighted to account for the number of students attending each campus. Students at larger institutions are more likely to have access to computing, which suggests that actual percentages of students with access may be higher than reported here, especially for the two-year institutions where the largest institutions, the Metropolitan and St. Louis Community College campuses, reported some computer access. However, another problem may weight the results the opposite direction: some of the smaller institutions did not complete this instrument. A summary of the findings follows:

1. Computing Skills: Overall, academic administrators estimated that approximately one-third of the students should have some programming skills. Intermediate and advanced programming skills were considered more important at the University of Missouri and elementary programming skills were considered more important at the other four-year institutions. The same administrators' estimates of current use show a greater percentage of indirect users at the other four-year institutions and greater percentages of elementary and advanced student programmers at the University of Missouri. It was estimated that nearly three-quarters of the students at the two-year institutions have no computer use.

2. Access to Computing for Instruction: Academic administrators estimated that between half and three-quarters of the students should have access to instructional computing. It is also estimated that a greater percentage of students at the University of Missouri currently make frequent use of computing for instruction and that a greater percentage of the students at the state four-year institutions are reported to make occasional use. See Table 13.

3. Student Research Uses: It was estimated that the majority of students, slightly over half, should not have access to computing for research purposes. Academic administrators at the University

felt that a greater percentage of students should have the computer be a major part of, or central to, their research. It was also found that a greater percentage of students at UM currently had access to computing for research.

The academic administrators' questionnaire also asked several questions that required written responses. These were designed to gather more detailed information on the uses of academic computing at the various campuses. A sample of the responses to these items follows.

4. Faculty Research Uses: one set of the open-ended questions asked if faculty used computing for research, if there were any local measures of this use, and if existing facilities limited use. The responses varied for each segment of institutions.

   At the University of Missouri, faculty at UMR and UMC appear to make the greatest use of computing for research. At UMR it is estimated that 50% of the faculty use computing in their research, at UMC it is estimated that 30% use computing. At UMKC and UMSL faculty use of computing for research is more limited. Budget limitations was cited as the primary limiting factor at UMKC.

   At the other four-year institutions the faculty use of computing for research also varies. Faculty at the regional universities, in particular, tend to make some use of computing for research. At Northeast, for example, it was reported that "utilization (is not) severely restricted, rather (it is) improving significantly."

   At the two-year institutions faculty use of computing for research is more limited. As one academic administrator, from SLCC at Meramec, put it: "Community college faculty, for the most part, do not do any of the kinds of research that normally require extensive amounts of computer time." In most instances, no faculty use of computing for research was reported.

The academic administrators were also asked to indicate what additional resources would bring about the optional use of computing in research. Budget restrictions and equipment limitations were cited in many instances. At UMR for example, it was pointed out that "new local hardware is needed for computer graphics, data acquisition and real time sharing." At the other four-year institutions the concerns were more varied. At Northeast, for example, it was pointed out that "the number of faculty utilizing computing in research would probably double if support personnel were available along with large batch capability, and additional software packages, particularly in statistics." For the two-year institutions improved research capability did not appear to be a key concern. However, in response to this question one of the two-year administrators, from Penn Valley, pointed out "we would like to expand CAI and train faculty in programming for this instructional mode."

5. Instructional Computing: A second set of the open-ended questions dealt with instructional uses of computing. The amount of instructional computing varied considerably across all institutions. UMR faculty and students appear to make the greatest use: "approximately 50% of the faculty and 90% of the UMR students make use of current instructional facilities. About 30% of the campus computing services are for instruction." At the other extreme, an administrator at SLCC Meramec pointed out: "at present, our faculty do not make considerable use of our computer facilities, although they certainly could if they wished to do so."

Regarding limitations on current uses of instructional computing, there were a variety of responses, usually emphasizing either equipment or training needs. At UMR the need for local hardware and computer graphics equipment was again emphasized. At Northeast, it was "access to computer terminals and to mini-computers." At Northwest, funds for retraining personnel was identified as a need.

Regarding the quality of training available to computer science and non-computer science students, there was also a wide variation in responses. The student demand for data processing and computer science courses was beyond the current capacity of some institutions like Southwest, where better laboratory facilities are needed for more hands-on experience by students. Most institutions that provide training in computer sciences and data processing, consider their graduates well trained and in demand by the industry. For example, an industry-based advisory council for the St. Louis Community Colleges has indicated the graduates of SLCC data processing programs have the precise training needed by the industry.

Regarding the need for additional resources to bring graduates to an adequate proficiency level, both personnel and hardware resources were identified as important. Hardware limitations were mentioned by campuses in each segment. In-service training for existing staff was also mentioned by two-year and four-year administrators. The Penn Valley administrator, for example, indicated a need for "funds for additional workshops on an in-service basis and support for upgrading staff already employed."

The majority of the state-supported higher education institutions in Missouri make some use of academic computing. An overall differentiated pattern was evident, with the greatest use at the UM campuses, followed by the other four-year institutions, and the least use by faculty at the two-year institutions. All three sets of institutions identified financial, hardware, and personnel constraints as factors limiting the academic uses of computing. Training of existing personnel is one area of need identified by most institutions, especially in the two-year and four-year institutions. Two types of training needs were identified: in-service training for computer center personnel and training for faculty in instructional computing techniques and applications.

Management Information System Development

On the Management Information System questionnaire, each institution was asked to identify its top five MIS development priorities. Table 15 presents cross-tabulations of the systems development priorities for the institutions reporting on this questionnaire. Some of the campuses that do not have automated systems did not respond to this instrument. Refer to the institutional profiles for indications of which institutions have automated systems.

The administrative areas in which the most systems development is planned are: Planning, Management & Institutional Research, Financial Management, Admissions & Records, and Financial Aid. In these areas, systems development is being considered at institutions in all three segments.

It is also evident from the responses to the MIS questionnaires that there are major differences between the current state of MIS development at the three segments. The UM central administration and campuses, some of the other four-year institutions, and the St. Louis Community College system are in the process of improving, updating, or modifying older systems that are already in production. The remaining four-year institutions and most two-year institutions are in the initial stages of automation.

Interest in the purchase of software systems from external vendors was expressed by many institutions. However, some cautions were expressed as well. The most important concerns about adapting new advanced systems as opposed to developing them from scratch are:

1. Making sure that there is adequate documentation of the software system;

2. Making sure the software system actually works (or that it has been proven elsewhere); and

TABLE 15. MANAGEMENT INFORMATION SYSTEM DEVELOPMENT

System Area	All Institutions	U.M.	Four-year	Two-Year
Priority #1				
Planning, Management, & Research	4	0	2	2
Financial Management	5	3	1	1
Admissions & Records	6	2	4	0
Financial Aid	2	0	0	2
Other Administrative Systems	1	0	0	1
Other Systems	1	0	1	0
Priority #2				
Planning, Management, & Research	1	0	1	0
Financial Management	8	3	2	3
General Administration	1	0	1	0
Logistics & Related Services	1	1	0	0
Admissions & Records	2	0	0	2
Financial Aid	3	0	2	1
Library Applications	1	0	1	0
Other Administrative Systems	2	1	1	0
Priority #3				
Planning, Management, & Research	2	1	1	0
Financial Management	3	1	1	1
General Administration	1	0	1	0
Auxiliary Services	1	0	1	0
Logistics & Related Services	1	0	1	0
Admissions & Records	4	0	2	2
Financial Aid	3	2	0	1
Priority #4				
Planning, Management, & Research	1	0	1	0
Financial Management	4	1	2	1
General Administration	1	0	1	0
Logistics & Related Services	2	0	1	1
Physical Plant	1	0	1	0
Financial Aid	2	0	0	2
Library	2	1	1	0
Other Systems	1	1	0	0

TABLE 15. (CONTINUED)

System Area	All Institutions	U.M.	Four-year	Two-Year
Priority #5				
Planning, Management, & Research	4	0	3	1
General Administration	1	0	1	0
Physical Plant	2	1	1	0
Administration & Records	1	0	0	1
Library	3	1	1	1
Other Administrative Systems	1	1	0	0
Other Systems	1	0	0	1
Total Priorities 1 through 5				
Planning, Management, & Research	12	1	8	3
Financial Management	20	8	6	6
General Administration	4	0	4	0
Auxiliary Services	1	0	1	0
Logistics & Related Services	4	1	2	1
Physical Plant	3	1	2	0
Admissions & Records	13	2	6	5
Financial Aid	10	2	2	6
Other Administrative Applications	4	2	1	1
Other Systems	3	2	1	0

3. Recognizing that there are some trade-offs, especially the loss of local procedural differences in order to adapt to standardized packages.

There was considerable evidence that continued computer development of administrative systems was needed by institutions in each segment of state-supported institutions. The attached profiles give a description of the status of MIS development for each campus. A summary of the status of MIS systems for each segment follows.

University of Missouri: All of the University of Missouri campuses have already developed management information systems. They have some system in production in each area. A variety of operating modes are used: batch, on-line, combined batch on-line. The MIS development priorities include new systems and refinement or modification of systems that are already in production. The UMR, UMKC and UMSL campuses have moderate to well developed MIS--with some automated systems in most areas. The UMC campus has a well developed MIS and is currently considering some refined systems such as induced-course-load-matrix analysis and student-flow modeling that were not being considered by any other institutions in the state.

State Four-Year Institutions: There was more variation in the state of development of the four-year institutions. Three of the regional universities -- Central, Southeast, and Southwest -- have one or more automated systems in production in most areas and they are considering modification or refinement of some of these systems. These institutions are likely to be using a mixture of processing modes: batch, on-line, and combined batch and on-line.

A second set of four-year institutions -- Lincoln, Southern, Western, Northeast, and Northwest -- have some of these systems in production in some of the areas identified on the questionnaire. These institutions identified new systems as their top MIS development priorities, with the exception of Southern, which wanted to convert existing systems from batch to on-line processing.

The remaining four-year institution, Harris-Stowe, has no automated systems and did not respond to the MIS survey.

Two-Year Institutions: The most extreme variation in the current status of MIS development is within the two-year sector. The two urban community college systems maintain automated information systems for the campuses and for central administration. For these campuses production systems are operating in most areas. St. Louis Community Colleges central office identifies refinement or modification of existing systems as the top MIS development priority.

Several of the other campuses have a few initial systems in production, usually using combined manual and computerized processing. Most of the non-urban two-year campuses make limited use of automated MIS. Usually they have contractual arrangements with outside firms or relatively modest in-house development if they have any automated systems. Several operate with entirely manual systems. Most consider computerization relevant for some systems.

Conclusions

State-supported higher education institutions in Missouri use computing for instruction in computer and information sciences and data processing, for other academic uses, and for administrative data processing. An analysis of seven-year trends in expenditures for computing and in the number of computer installations in Missouri and in the entire U. S. shows that while the number of installations has increased in this state, the amount of expenditures on higher education computing in Missouri have not kept pace with national trends. In addition, a recent study of computer and information manpower needs indicates that Missouri and neighboring states are undersupplied in most computer, information science, and data processing related manpower categories. Further analysis of number of degree programs, enrollments by program, and number of program graduates indicates that existing higher education programs in computer related areas are not adequate. Expansion of four-year programs in computer and information sciences and two-year programs

in data processing may be needed to meet current and forecasted manpower needs.

The survey of computing in Missouri state-supported higher education institutions revealed a great diversity in the quality and availability of computing resources. The most extensive development of computing resources has taken place in the University of Missouri system, which has an excellent computer network. The regional universities, state colleges, and metropolitan two-year colleges have developed stand-alone computer facilities that meet many of their local computing needs. The level and quality of service provided by these stand-alone facilities does not equal the level and quality of service, in either administrative or academic areas, provided by the University of Missouri network. Two of the four-year institutions, Northwest and Lincoln, currently have access to the University of Missouri network and potentially can exploit these specialized capabilities. Several of the other institutions in the state, especially Harris-Stowe College and the non-urban community colleges, have not been able to exploit fully the potentials of computing for academic or administrative uses. Several of these institutions currently have no access to computing resources.

Chapter V

STATE-WIDE OBJECTIVES FOR HIGHER EDUCATION COMPUTING IN MISSOURI

Prior to the formation of the Computer Policy Task Force in August, 1978, there had been no history of state-wide planning for computing in Missouri higher education. Consequently, state-wide goals for computing had not been previously identified. The Computer Policy Task Force therefore first set about the task of identifying and recommending a set of state-wide objectives for computing in Missouri higher education.

As part of the Task Force study of higher education computing in Missouri, a questionnaire was used to assess the appropriateness of a list of general and specific objectives being considered by the Computer Policy Task Force. This instrument was completed by the chief executives of each institution or, in a few instances, by individuals designated by the chief executives. It was designed to assess presidents' and chancellors' attitudes about the appropriateness of each possible objective and about how well each objective was currently being met at their campus. The analysis of the questionnaire responses is included in Appendix H.

The response to this survey, in addition to other findings, has guided and informed the Task Force's deliberations about objectives to recommend to the Coordinating Board of Higher Education. The survey results indicate a relatively high consistency in the appropriateness ratings for each objective by the institutions. There were, however, significant differences in the perceptions of the top administrators about how well the specific objectives are being met at their campuses. With a few exceptions, the specific objectives were rated consistently by institutions in all three segments on the appropriateness scale, while the degree to which these objectives were perceived to be currently being met varied by institutional segment. The University of Missouri campuses are meeting most state-wide computing objectives, while the other four-year institutions appear to be reaching these objectives with less

consistency than the University of Missouri campuses, but to a higher degree than the two-year institutions.

This finding, which is supported by the other study results, has guided the Task Force deliberations about state-wide computing objectives. The Task Force recognizes the differentiated pattern of computing resources and achievement: the University of Missouri has made a more extensive investment of financial and human resources in computing than either the other state four-year institutions or the state two-year institutions. At the other extreme, a few of the four-year institutions and several of the two-year institutions have not exploited the potentials of computing for academic or administrative purposes.

The Task Force also recognizes that there is room for improvement in the organization and use of existing computing resources. While some high quality computing services are provided by institutions in each segment, there are apparent inefficiencies in the current pattern of computing resources; current computing and communications technologies have not been fully exploited on a state-wide basis. In addition, the Task Force recognizes that there is room for improving the quality of computing services at all institutions in the state and that the level of funding of computing in Missouri has not kept pace with national trends. In particular, computing at the other four-year and two-year institutions can be improved.

It is in this context that the Task Force has identified a set of state-wide computing objectives. In particular, it has been the intent of the Task Force to recommend a set of state-wide objectives that will enable individual institutions to identify local objectives as well as lead to improved cooperative mechanisms for institutions wishing to improve their computer operations. It is also the intent of the Task Force to recommend a set of objectives that enable institutions to respond to the needs for trained computer and information processing personnel in Missouri industries. Toward these general ends, the Task Force endorses the following general and specific state-wide objectives for higher education computing in Missouri.

General Objectives - Recommended

1. *Missouri higher education institutions should have ready access to computing facilities, personnel and software capable of meeting computing needs and objectives identified in the following areas by each institution as commensurate with their individual missions:*

   a. *academic uses (including instruction and research);*
   b. *library uses;*
   c. *administrative (including financial and student information control systems);*
   d. *public service (including the possibility of providing computing services, on a cost recovery basis, to schools, other colleges and universities, and local, state and federal government agencies).*

2. *Higher education in Missouri should attempt to meet current computing needs by as effective and efficient means as possible. Effectiveness refers to providing levels of service generally considered desirable and appropriate and efficiency refers to finding the most economical means possible of providing these services. Effectiveness and efficiency should be considered in tandem since the most economical methods of providing services are not always the most appropriate for the users and therefore can, at times, decrease effectiveness. However, the relative costs of different hardware, software, and personnel alternatives must be considered when evaluating possible strategies for achieving state-wide objectives. Measures of effectiveness and efficiency should take into account institutional objectives, user needs, hardware costs, software development costs, and personnel requirements.*

3. *The cost of developing computing services, including personnel and other software development costs, should be shared among several institutions whenever this resource-sharing approach*

can reduce the overall costs of development and maintenance of computing systems and provide for other benefits such as greater standardization.

Specific Objectives - Recommended

1. *Every student in higher education should have the opportunity to acquire computing skills. This implies more than "computer appreciation" courses which do not include actual computer programming usage.*

2. *Students in noncomputer-science curricula should have access to the computer if it has become a commonly used tool in their particular field of study. This implies the existence of specific types of computing that are needed by the discipline and may require facilities for original programming.*

3. *Students in computer and information science and data processing curricula should have access to sufficient computing resources to assure that as graduates they are adequately prepared to work in computing and information processing positions in industry, government, or education.*

4. *Addition of new degree and certificate programs in computer and information sciences and data processing, as well as expansion of existing programs in these areas, should be a high priority for state-supported institutions that have necessary faculty expertise and sufficient student demand.*

5. *Training should be available to faculty who wish to become familiar with computer applicatons in their disciplines. Such training could include instruction in computer programming, but should not be limited to that, since there are needs to learn computing techniques in the teacher's own discipline--e.g., the use of statistical packages and instructionally-oriented data bases in the social sciences, or the technique*

of developing computer supported instruction modules as supplements to their traditional instructional practice.

6. *Technical consulting and other academic support services should be available to faculty computer users at all institutions, either locally or through a central support organization.*

7. *All institutions of higher education should be able to acquire computing capability, not necessarily via an on-campus computer, for both administrative and academic needs.*

8. *All institutions should utilize existing resources for administrative and academic computing when available at other institutions or commerically instead of developing them locally.*

9. *Administrative computing requirements for state-supported higher education in Missouri, including the needs for on-line data base management, systems development and acquisition, and staff training and retention, should be studied and where inadequacies exist, solutions developed on an interinstitutional cooperative basis whenever appropriate.*

10. *The potentials of instructional computing, including of computer-assisted and computer-aided instruction, should be more fully exploited by Missouri higher education. Cooperative approaches to the development of instructional computing should be utilized as appropriate.*

While the Computer Policy Task Force endorses the general and specific objectives stated above, it also recognizes that statement of objectives alone will not assure these ends will be achieved. The appropriateness of different mechanisms for achieving these objectives in Missouri are considered in Chapter VI. This analysis provides the basis for the action recommendations included in Chapter VII.

Chapter VI

FACILITATING COOPERATIVE COMPUTING IN MISSOURI HIGHER EDUCATION

The Computer Policy Task Force has assessed the status of computing in the state and the prospects for cooperative computing ventures. Task Force consultants have provided background on state-wide computing activities elsewhere and for delineating policy alternatives to the Task Force. The Task Force has identified areas where deficiencies exist and considered alternate mechanisms for addressing them. After considering a variety of possible approaches, the Task Force has decided to recommend a facilitating organization that can encourage and facilitate development in necessary areas.

The principle assumption underlying the Task Force recommendations is that computer hardware is not the major obstacle to achieving the state-wide objectives identified in Chapter V. While there are some hardware deficiencies in the state, in fact some institutions have no computing facilities, these limitations are not as much of an obstacle to achievement of the state-wide objectives as the coordination and personnel training problems facing all institutions in the state. The CPTF survey results indicated that faculty and staff development and training are one key to realizing the potentials of computing in both the academic and administrative areas. Another problem has been the limited computer resource sharing to date among institutions in the state which has resulted from the absence of a state-wide cooperative mechanism for planning and development. The Task Force has concluded that these problems face institutions in each sector of Missouri higher education and that solutions can be developed on a cooperative basis.

The best way for institutions to increase the computing resources which support their missions is effectively to demonstrate good faith efforts in support of a facilitating mechanism that will protect both institutional and public interests. This strategy is also the best insurance that together the institutions, rather than the MDHE and/or OA, will be the dominant force in the facilitating organization.

The Functions of a Facilitating Organization

While most observers feel that the facilitating organization is likely to be the most common type of computing cooperative in the future, it is difficult to identify precisely what a facilitating organization is. There are few "pure" examples of true facilitating organizations. The reasons are that different facilitating functions make sense for different computing environments and many existing networks are embracing facilitating functions in addition to their other activities.

It is important to recognize that a facilitating organization cannot be all things to all people. Such an organization makes available a range of services and functions from which institutions may choose whatever suits their needs. Some institutions may choose fully to utilize these services, while others may not need to. The primary goal of a facilitating organization is not control, but the provision of services. To be successful, this organization must provide services that address real needs and create an incentive structure that rewards institutions for utilizing its services appropriately. The following functions are possible for a facilitating organization.

Provide leadership for the state in computing developments. The facilitating organization could keep informed of national developments in computing, networking, and other cooperative matters. The organizations could maintain contact as a member, with CONDUIT and EDUNET (which attach a distinct cost advantage to having a single contact person) and with national resource-sharing organizations, such as EDUCOM, HEN, library networks, CAUSE, ICPSR, PLATO, and others. The director could both serve as a clearly identified contact person to communicate with computing personnel in the state about national developments. For example, the organization could provide a "local distributor function" by facilitating

access by Missouri institutions to EDUNET suppliers. Another possibility is assuming a leadership role in coordinating multi-institution grant proposals to increase computer power or attempt new applications in Missouri. The competition for such funds is getting progressively more difficult, and joint proposals have a greater chance of success.

Serve as information clearinghouse. The facilitating organization could serve as a central collection point for information on what is going on in Missouri and across the nation. Information on national resources and software packages could be maintained. The organization could maintain a documentation library and/or a central software library; it should probably distribute a newsletter dealing with such matters.

While individual computing center directors will also be knowledgeable of national developments, cooperative possibilities, and other factors, the facilitating organization would be a single focal point group for addressing these issues. Knowledgeable computing center directors (together with certain faculty and other staff) could serve as resource persons to the central organization, which through its activities would enable all institutions to benefit from their expertise and leadership. Such arrangement might enhance the level of understanding of both the facilitating organization staff and the computing center directors. Moreover, the facilitating organization could provide a mechanism for assisting "have-not" institutions, which have relatively little sophistication in computing, in taking advantage of cooperative possibilities.

Provide training and staff development. The facilitating organization could hold special workshops for faculty that utilize expertise that is not available to each of the individual institutions. These activities could be cooperative efforts in conjunction with institutions which might already have such programs. Discipline-oriented faculty workshops have been especially well received in some states.

Direct planning for higher education computing in Missouri and measure achievement of state-wide and institutions' goals for computing. The facilitating organization could function as an active, independent voice in support of planning for achievement of state-wide goals for increased computing power in Missouri. Such an organization would need to balance institutional advocacy and responsible service to the state. If successful in achieving this balance, the need for additional scrutiny from the state agency responsible for data-processing review could be eliminated.

Function as computing advocate and raising the consciousness of under-served institutions. In conjunction with its planning role, the facilitating organization could alert under-served institutions to the services which they may wish to develop locally or obtain off-campus. These institutions would not need to go through all the developmental stages of computing and make all of the same mistakes in expanding computing power. The facilitating organization could help assure that such growth would occur in the most effective manner possible.

Assist in preparation of specifications, equipment selection, and achievement of favorable terms of purchase/lease. Through participation in the planning activities, the facilitating organization may be able to assist institutions in deciding on new equipment, and in some instances even put together a purchase package which would be highly cost-efficient. This would go beyond merely using a state purchasing/bid system; it could result in both cost savings and the selection of the best mix of systems for the state institutions.

Provide software development and instructional time-sharing service, if conditions warrant. Instructional time-sharing or development of instructional software is the area in which the central organization could most likely be called on to provide actual service. Such instructional services might be available either from a central site, from on-campus micro-computers, or a combined approach with "down-loading" of software.

In considering these functions which the facilitating organization might assume, it is important to understand that the whole is greater than the sum of its parts. A facilitating organization would be better able to provide assistance in purchasing and selecting equipment by virtue of its participation in state-wide planning. Even if the institutions in a state perform one or more of the major functions of a facilitating organization in an effective and coordinated manner, the state can profit from a clearly identified, active facilitating organization.

Activities of a Facilitating Organization

One of the most important activities of the facilitating organization would be training faculty and staff, especially those of the smaller institutions. In the instructional area, there are needs for training in computing techniques as applied to specific academic disciplines as well as the obvious requirements for training in programming and computer science. Resource persons from institutions already heavily involved in academic computing should be utilized in this effort. Thus, the central staff need not have expertise in a variety of disciplines, since the objective can be accomplished by organizing workshops and arranging for qualified institutional personnel to make presentations. Equally important, however, is the availability of follow-up technical consultation and general personnel support; this would have to be provided or coordinated by the central organization staff. Without some new organization providing such services, it is not likely that the less developed institutions can be rapidly brought up to the present state-of-the-art in academic computing. Certainly the problem is not solved by simply placing computers and/or terminals at all of the institutions.

Since a cooperative approach toward developing computer-based applications utilizes faculty and staff expertise already employed by the institutions, the impact should far exceed the sharing of central staff technical know-how. The director must make a concerted effort to amplify the expertise of his/her own staff by identifying and utilizing resource persons from throughout higher education in Missouri. The technology and its applications are expanding so rapidly that no one person can

stay abreast of all developments. The facilitating organization will have to draw upon the resources of the member institutions because it will not be possible nor desirable to add specialists in communications, microcomputers, administrative data processing, etc. The facilitating organization could to insure institutional their in these areas are shared state-wide, and that opportunities are not overlooked in volume discounts on equipment, joint development of software, or other cooperative opportunities.

In the academic area, faculty workshops provide an excellent opportunity for idea exchange between peers in a given discipline, and such opportunities might not exist without the type of cooperative effort proposed. With respect to larger institutions, it is not true that heavy computer use (specifically in research) implies that the computer is being used widely at the classroom level. It is quite common for a professor to say that, although he uses the computer frequently in his research, he has never developed an application in undergraduate instruction. Often, however, faculty are eager to get ideas from colleagues. A cooperative effort which draws upon the faculties of all institutions in the state can identify key people who are leaders in instructional computer use and who are not necessarily at research-oriented institutions. Faculty members who have utilized computers in research can therefore benefit from the work that colleagues have done in the classroom, and they often wish to take advantage of already-developed instructional software.

Clearly, much of the success of a new facilitating organization will depend upon having the right type of person as director. It may prove difficult to attract the calibre of person needed for an organization of this type (few states have obtained experience in this regard). The search for a director would probably require more time and effort than recruiting someone to manage a traditional computer center or network, for the new organization will need to prove its worth and to win the respect of the institutions it is designed to serve. In spite of inherent difficulties, however, the Task Force believes the effort should be attempted, since the potential payoff is very great.

Organizational Considerations

To function effectively such a facilitating organization would need to be staffed with a director who possessed sufficient stature and knowledge of computing to be able to deal with computing center directors on relatively equal footing. At the very least, such a person would probably need to be supported by one or two technical staff and by secretarial staff. This organization would also need to be supported by various advisory groups. While the facilitating organization would need to establish its credibility and independence, there are a number of suitable organizational placements for it: (1) an independent legal body (not-for-profit-corporation); (2) a branch of the Office of Administration/ Division of EDP Coordination; (3) an agency of the Department of Higher Education; or (4) affiliation with an educational institution, or group of institutions. It might be feasible to identify some functions, such as maintenance and analysis of a statewide facilities inventory, which could be contracted out to an individual institution(s).

A facilitating organization would seem to be especially appropriate for a state such as Missouri. Many of the institutions are relatively under-served by computing, and while cooperative interaction and developments have been increasing, there is substantial room for improvement. A facilitating organization with an articulate, capable staff could advocate for increased computing power and facilitate a movement into the mainstream. It could also provide a number of tangible, useful services. Such an organization, providing a range of optional services from which institutions could choose, would also involve in some way most of the institutions in Missouri, from community colleges to the University of Missouri.

A first step would be to establish a coordinating committee with broad representation from the institutions. Such a group could, to a limited extent, identify opportunities for cooperation and resource sharing and promote such activities. However, a committee alone would not be sufficient. At least a director and small support staff as described above will be required if substantial progress is to be made. Results may be expected to be proportional to the amount of time devoted to the

effort. The needs are too great and the opportunities too extensive for a committee of people trying to do this in addition to other, full-time responsibilities.

The Computer Policy Task Force does not believe that establishing a not-for-profit corporation to support these coordinating functions is worth the effort and overhead, at least initially. Such independence might be more appropriate after a new organization has matured and its activities have been stabilized, however. In that way the value of incorporation would be better understood vis-a-vis the actual activities underway, and benefits could be weighed against the effort and costs involved and any perceived disadvantages.

A facilitating organization will, of course, need one or more committees associated with it. The director should report to a board consisting of representatives from the Missouri Department of Higher Education, the institutions (with at least all categories of institutions represented) and other agencies and organizations as appropriate. To achieve neutrality (with respect to the institutions), it probably should be affiliated in some manner with the Missouri Department of Higher Education.

The overall approach being considered allows considerable flexibility. A range of alternative hardware and software strategies that can be considered by the facilitating organization are presented in the consultant report (by Lewis Parker in Appendix D). Different strategies can, and should, be selected depending on the nature of the requirement and the particular subset of institutions to be served. Although certain strategies are not contingent upon the existence of some new organization, it seems clear that a central staff could do much to broaden the range of available alternatives, provide technical and administrative support, and generally facilitate cooperative action where appropriate.

For the reasons set forth in this chapter, a key recommendation of the Computer Policy Task Force, designed to support achievement of the objectives summarized in Chapter V, is the development of a facilitating organization. This and other recommendations are detailed in Chapter VII.

Chapter VII

RECOMMENDATIONS

The Computer Policy Task Force has considered the results of the study of computing in state-supported higher education institutions in Missouri and several alternative approaches to meeting current computing needs. Based on this study it has developed a set of recommendations to the Coordinating Board of Higher Education (CBHE). These recommendations are intended to promote the achievement of the objectives set forth in Chapter V, and draw largely on the conclusions summarized in Chapter VI.

The first set of recommendations support the establishment of a facilitating organization. The remaining recommendations suggest desirable outcomes and possible means for the facilitating organization to meet them.

Establishing A Facilitating Organization

During the course of the Computer Policy Task Force's study of computing in Missouri higher education, several state-wide facilitating functions were identified by the Task Force. These functions have been detailed in the prior chapter and in the consultant reports to the Task Force (Appendicies D and I). In order to accomplish these functions, and to provide a mechanism through which the specific state-wide objectives recommended by the Task Force may be accomplished, it is recommended that:

1. The CBHE create a state-wide higher education computing consortium in Missouri, to be known as the Missouri Center for Higher Education Computing (MoCHEC), that will have as its primary functions:

a. To serve as an information clearinghouse for higher education computing. This function may include maintaining listings of computer hardware and software and administrative and academic applications, publishing a newsletter, disseminating information from national computing organizations, and serving as a focal point for Missouri participation in national resource-sharing organizations.

b. To facilitate the development and support of academic and administrative computing. This function may include workshops that introduce faculty to computer applications in their disciplines, workshops that concentrate on special administrative applications, and training programs for data-processing personnel.

c. To provide a formal voice for higher education computing in the state. This function may include encouraging planning for higher education computing and assessing achievement of state-wide objectives.

d. To encourage actively development of appropriate levels of computing resources at all colleges and universities. This may include encouraging interinstitutional cooperation in the development of new computing capabilities at all institutions.

The major thrusts of MoCHEC will be to provide services to all Missouri higher education institutions and to encourage the most cost-effective uses and development of computing. Initally, the functions of the MoCHEC will be limited to the functions outlined above. As the organization develops, new functions may be considered: assisting in the preparation of specifications for equipment acquisitions, obtaining favorable purchase/lease arrangements for hardware and software, and maintaining an instructional time-sharing system. While the Task Force recognizes the potential value of these latter functions to Missouri higher education, their appropriateness can be determined better after MoCHEC has demonstrated its ability to implement the initial functions outlined above.

In the future it may be appropriate to consider whether MoCHEC should be involved in the equipment acquisition and approval process currently performed by the Office of Administration/Division of Electronic Data Processing Coordination, but initally MoCHEC should be divorced from that control function. If it should be determined sometime in the future that MoCHEC's facilitating functions are compatible with this control function then a mechanism for involving MoCHEC in this process should be explored. Should MoCHEC become involved in control functions it should be in such a way as not to add a new layer of bureaucracy, but rather to replace or facilitate the existing process.

As a means of implementing the initial functions of MoCHEC, the CPTF recommends:

2. MoCHEC should be governed by a policy board composed of eleven persons, including seven administrators or faculty from state-supported institutions (two from the University of Missouri, two from the regional universities and Lincoln University, one from the state colleges, and two from the community colleges), two administrators or faculty from the independent sector, the Commissioner of Higher Education or his/her designee, and the Director of OA/EDPC or his/her designee. Institutional members of the policy board shall be appointed by the presidents of their respective institutions. The policy board should elect its own officers and appoint such technical advisory committees it considers appropriate.

3. The MoCHEC policy board should oversee implementation of the CPTF's recommendations for the establishment of MoCHEC and the evaluation of other cooperative opportunities. This implementation process will involve the institutional and governmental representatives in a further participatory process of decisionmaking. Implementation will be an ongoing process of refinement and adaptation of the CPTF recommendations.

4. MoCHEC should maintain a small professional staff as described in Chapter VI, and should rely in addition on personnel at Missouri educational institutions or other organizations, as appropriate, for workshops and other training and developmental activities, and thus be able to provide institution access to expertise not always available at the local level.

5. The CBHE should direct the commissioner, in cooperation with the MoCHEC policy board, to develop a budget recommendation for MoCHEC for FY 1981 that will provide for staff, space and other necessary expenses. In the interim, the Commissioner should use any available resources to provide for the short term functioning of MoCHEC until regular funding can be secured.

6. During its first two years of regular funding, MoCHEC should be supported 100% from state appropriations. In subsequent years, MoCHEC should be supported by a combination of state appropriations, institutional dues, and payments for MoCHEC services. A specific plan in this regard is to be developed by the MoCHEC policy board. This arrangement should ensure ample opportunity for MoCHEC to establish itself before having to depend on satisfied users for support.

Computer Resource Sharing

A major concern of the Computer Policy Task Force throughout its deliberations has been the dual challenge of extending computing resources and capabilities to institutions without creating excessive duplication in computer hardware and perpetuating unneeded inequities in the system of access to computing resources. The Task Force has also attempted to design a computer resource-sharing strategy that takes advantage of the current pattern of computer development in Missouri and of current and anticipated technological developments in the computer and telecommunications industries. To the extent possible, the Task

Force endorses a strategy that retains local control over computer processing priority decisions. The future of computer resource sharing in Missouri is dependent on recognizing the uniqueness, both strengths and weaknesses, of the system that already exists.

To accomplish this end an overall resource-sharing strategy needs to recognize the current state of development of the University of Missouri computer network and the value that it can add to computing capabilities of other institutions in the state; the regional universities and some state colleges and two-year colleges have developed stand-alone computing facilities which represent a considerable investment and which may, in some instances, have the capacity to provide services to other schools and colleges in their regions; and many of the two-year institutions in Missouri have not yet had the opportunity to develop computing resources. To develop a computer resource-sharing approach that recognizes these strengths and limitations, the Computer Policy Task Force recommends:

7. The CBHE request the MoCHEC policy board devise a computer resource-sharing policy, to be endorsed by the CBHE, that achieves the following:

    a. Provides access to computing at each higher education institution in Missouri.

    b. Develops appropriate computing capacities at state-supported institutions that do not now have computing capabilities. The appropriateness of different hardware arrangements should be explored. Possible hosts for networking include the community colleges which have already developed extensive computing capability, the University of Missouri network, or one or more regional universities. Host centers must be committed to developing the necessary services to support remote users.

c. Provide general access to the unique computing resources of the University of Missouri, or other institutions, providing such access to such resources is cost effective.

Administrative computing in Missouri higher education is not fully developed in most institutions. There are many similarities in the administrative data processing needs of the various institutions in the state. For example, all institutions are subject to many common external reporting requirements (MDHE and HEGIS). There are also significant differences: the University of Missouri campuses have the administrative support of central administration; the regional universities and state colleges, which do not have such central administrative support, are each subject to common state accounting procedures and reporting requirements; and the community colleges are the most in need of development and study in their potentials for administrative computing. As evidenced by the responses to the CPTF survey, there are possibilities for improving the administrative computing at all state institutions.

One area where improvement is possible is in the systems development process and in the development of compatible systems where possible. Toward this end the Task Force recommends:

8. For administrative data processing at state-supported institutions, commercially available systems or systems implemented at other Missouri institutions should be acquired when considered appropriate and beneficial by the purchasing institutions. Purchases should, where possible, be made with provisions for sharing between campuses. Decisions by individual institutions should be based on technical feasibility, economic considerations, and appropriateness of the situation. Shared-purchasing strategies can be explored and implemented by MoCHEC when it is created.

The potentials for cooperative development in the use of administrative computing in Missouri higher education need to be further explored. All of the UM campuses and the UM central administration have well developed administration computing capabilities. The other state-supported institutions are more varied in their uses of administrative computing; some institutions have moderately well developed systems, while others have not yet exploited the uses of computing in administration. In order to identify more specific problems facing administrative computing in state-supported institutions in Missouri, the CPTF recommends:

9. The CBHE request the MoCHEC policy board to conduct a detailed study of the administrative computing needs of state-supported institutions in Missouri, specifically considering the following topics:

    a. the possibilities and cost-effectiveness for the development of compatible information systems at the state-supported institutions.

    b. the possibilities and potential for development of specialized services by some institutions.

    c. specialized strategies for developing the appropriate administrative systems, including the potentials for resource sharing, at state-supported institutions that have not yet developed such support.

Academic computing has not been fully utilized in Missouri higher education. Two of the earlier recommendations will have a major impact on improving the potentials of academic computing. First, the creation of a state-wide facilitating organization (MoCHEC) with responsibility for initiating training programs for faculty should improve instructional computing. Second, MoCHEC can facilitate for each institution access to specialized computing resources that can enhance instruction and research in specialized areas. In addition to these broad changes three additional recommendations are considered important by the Task Force.

First, the study of manpower needs in the computer and information processing industries in Missouri, has shown that the supply of trained individuals is inadequate. On the bright side, it appears that individuals who are trained in the two-year and four-year programs in data processing and computer and information sciences are well trained and appear to meet the needs of the industry. In order to increase the numbers of such graduates, the Task Force recommends:

10. That the CBHE adopt a policy of encouraging institutions to develop quality instructional programs in data processing and computer and information sciences at the two-year and four-year levels and in computer and information sciences at the master's level. Such programs should be developed in sufficient numbers so as to adequately meet the identified need yet avoid an overbuilt status. In addition, institutions should be encouraged to identify and meet the in-service training needs of industry. Certificate programs designed to meet in-service needs should also be a priority for approval by the Board.

Second, the potentials of instructional computing in undergraduate education need to be developed further in Missouri. Undergraduate education should be emphasized because the commonly used instructional methods, CMI (Computer Managed Instruction) and CAI (Computer-Aided Instruction), have the most potential applications at the two-year and four-year levels. While the Task Force considers graduate instruction important, and encourages the institutions to use computing in graduate instruction and research, it has no specific recommendations for the CBHE in these areas. Regarding the uses of computing in undergraduate instruction, however, the Task Force recommends:

11. The CBHE request the MoCHEC policy board to conduct a study of the potentials for improving the uses of computing in undergraduate instruction. The possibilities to be explored will include:

    a. creation of a computer-aided instruction or instructional time-sharing center in the state;

    b. identification of special training needs of faculty;

    c. identification of areas where existing instructional materials could be used and new materials could be developed;

    d. identification of methods and procedures to evaluate the effectiveness of instructional computing applications.

Third, while the CPTF deliberations have not considered the uses of computing for libraries in depth, it has reviewed materials on national and state plans to automate library systems. Further, the Task Force recognizes that Master Plan III for Postsecondary Education in Missouri has recommended state-wide planning take place in this area and that the Missouri State Library is attempting to implement these recommendations. Toward the general end of improving the service and efficiency of Missouri's libraries, the Task Force recommends:

12. The CBHE continue to support the implementation of MP III recommendations that Missouri exploit information storage and processing technologies to improve the services provided by Missouri's libraries, including college and university libraries. In particular, the continued CBHE support for the state-wide catalog data-base project is encouraged.

Conclusion

From its first meeting, the Computer Policy Task Force has approached its work with the diverse perspectives of its several members. On the occasion of the Coordinating Board action establishing the Task Force, one member of that Board remarked that "there is no chauvinism like computer chauvinism." Although that comment suggested prescience of the Task Force's difficult struggle throughout the year of its life, in the end the Task Force is satisfied that it has described objectives and recommendations for Missouri higher education computing which appropriately transcend the individual perspectives of Task Force members. This final report is recommended in total by the Computer Policy Task Force for the positive consideration of the Missouri Coordinating Board for Higher Education and the higher education community.

LIST OF APPENDICES

Appendix A: List of Computer Policy Task Force Members

Appendix B: Meetings of the Computer Policy Task Force

Appendix C: Work Plan For the Computer Policy Task Force

Appendix D: Consultant Reports to CPTF

Appendix E: References Distributed to Computer Policy Task Force

Appendix F: Survey Instruments

Appendix G: Profiles of Computing at Missouri Institutions

Appendix H: State-Wide Objectives Assessment Questionnaire Results

Appendix I: Alternative Strategies for Computing

Missouri Department of Higher Education
Computer Policy Task Force Members

Community Colleges	
Dr. Rus Slicker	Vice Chancellor St. Louis Community College
Mr. Mick Long	Business Manager Jefferson College
Mr. Aldo Leker	President Longview Community College
State Colleges	
Mr. Ken Hawk	Business Manager Missouri Western State College
Regional Universities	
Dr. B.D. Owens	President Northwest Missouri State University
Dr. Darrell W. Krueger	Dean of Instruction Northeast Missouri State University
Mr. Thomas Allen	Comptroller Southwest Missouri State University
University of Missouri	
Mr. James R. Buchholz	Vice President for Administrative Affairs
Dr. Richard L. Wallace	Associate Dean-Graduate School University of Missouri-Columbia
Mr. R. Bruce Briggs	Director of Office of Computing Activities
Computing Directors Council	
Dr. Jack Thompson	Director, Computer Center Southeast Missouri State University
MDHE	
Dr. T. Michael Elliott Task Force Chairman	Deputy Commissioner Missouri Department of Higher Education

Computer Policy Task Force Members

Consultants

Mr. Louis T. Parker	Director, North Carolina Educational Computing Services
Dr. Donald M. Norris	Director, Institutional Studies University of Houston

Observer/Participants

Mr. Mike Boxberger	OA/EDPC
Mr. Stanley Z. Koplik	MDHE Director of Fiscal Affairs
Dr. Edward P. St. John	MDHE Associate Director of Research and Planning
Mr. Robert Benson	ICUM Assistant Vice President of Financial Planning System Washington University
Mr. Boyd Eversole	MACJC Executive Director
Dr. John Moore	DESE Assistant Commissioner

Appendix B

LIST OF MEETINGS OF COMPUTER POLICY TASK FORCE

MEETING:	TOPICS:
First Meeting September 20, 1978 Ramada Inn Jefferson City, MO	I. Introduction II. Charge to Task Force III. Presentation to Task Force by Dr. John Hamblen, Chairman, Computer Science Department, University of Missouri-Rolla IV. Consideration of Agenda of Task Force
Second Meeting November 9, 1978 Brady Common University of Missouri-Columbia Columbia, MO	I. Discussion of Problem Statement and Work Plan for Task Force II. Discussion of Possible Objectives for State-wide Computing III. Discussion of Potential Hardware and Software Strategies

Third Meeting

December 11, 1979
Whittemore House
Washington University
St. Louis, MO

I. Approval of Draft Problem Statement and Work Plan for Task Force
II. Discussion of State-wide Objectives
III. Discussion of Potential Computer Hardware and Software Strategies for Missouri

December 12, 1978
Mid-Illinois Computer Cooperative (MICC)
Southern Illinois University
Edwardsville, IL

I. Tour of MICC Facility
II. Presentation by Walter Parrill, Executive Director, MICC: "MICC: Past, Present, Future"

Fourth Meeting

January 8, 1979
Whittemore House
Washington University
St. Louis, MO

I. Panel of State-wide Computer Network Directors:
Dale LaFrenz, Director of Instructional Services, Minnesota Education Computing Consortium (MECC);

Chuck Shomper, Director, West Virginia Network for Educational Computing (WVNET);

Fourth Meeting (continued)	Louis Parker, Director, North Carolina Educational Computing Services (NCECS). II. Review of Draft Survey Instruments
Fifth Meeting February 13, 1979 Whittemore House Washington University St. Louis, MO	I. Presentation by Mr. Steven Adler, IBM Corporation: "Future of Computing Technology in Higher Education" II. Discussion of Possible Outcomes of Missouri Planning Effort
Sixth Meeting April 18, 1979 MDHE Office Jefferson City, MO	I. Discussion Survey Results of Missouri Computer Study II. Discussion of Possible Task Force Recommendations III. Discussion of Possible Facilitating Functions
Seventh Meeting June 19, 1979 MDHE Office Jefferson City, MO	I. Review of Draft Computer Policy Task Force Report II. Review of Draft Consultant Reports to Task Force III. Consideration of Task Force Recommendations

Eighth Meeting

July 27, 1979

MDHE Office

Jefferson City, MO

I. Review of Institutions' Response to Draft CPTF Report

II. Revision of CPTF Recommendations

Ninth Meeting

August 3, 1979

MDHE Office

Jefferson City, MO

I. Final Review of Task Force Force Report and Recommendations

II. Approval of CPTF Final REport and Distribution Plan

WORK PLAN FOR THE COMPUTER POLICY TASK FORCE

(Draft - November 28, 1978)

To a large extent the problems facing Missouri are the same as those facing other states that have not previously undertaken comprehensive state planning for higher education computing. The materials already distributed to the Task Force provide a basis for this outline.

I. Context: Establishing a Policy Framework for Computing In Missouri Higher Education. The overall objective of the Computer Policy Task Force is to establish guidelines and a policy framework to assure that Missouri higher education moves into the mainstream of academic and administrative computing. Recent changes in computer technology, the demands to upgrade campus computer centers, the need for a framework for reviewing and approving such requests, the potential for resource sharing, and the need to identify priority areas for future development of computing in Missouri higher education all define the agenda for the Task Force.

   A. Priorities for Future Development. Once an agenda for the future of computing in Missouri higher education is established, the Task Force should prioritize specific areas for further development or study. In some areas the status quo may be adequate and therefore further development may not be needed. However, for those areas where further development is required to implement Task Force recommendations, priorities should also be recommended by the Task Force. These might include further study by a specialized group on the potential for computer-aided instruction (CAI), as one example.

   B. Potentials for Resource Sharing. The potential for sharing some of the costs of computing is another issue to be considered by the Task Force. The Task Force has been given the difficult task of considering which areas are best developed cooperatively, through sharing by several institutions in the state or by groups of institutions, and which are best developed by individual institutions. The Task Force should consider the prior history of computer-system development in Missouri higher education institutions and of attempts to coordinate computer planning in other states. Task Force deliberations should include the potentials of software, as well as hardware, sharing for both administrative and academic computing. It should also consider methods of implementing, including the practicalities of general and/or specialized networks in the state.

C. Demands to Upgrade Campus Computing Facilities. Dr. Hamblen's presentation at the first meeting sets the context for examining this issue. Expenditures for computing in Missouri have increased dramatically during the past decade, but these have not kept pace with national increases. Between 1969-77, expenditures for computing increased by 65% in Missouri higher education (68% in public institutions) compared to a 110% increase in expenditures nationally. While expenditure data are not perfect indicators of computing resources, the data do suggest that Missouri is likely to face continued demands to upgrade computing facilities and services. Anticipating the general nature of these demands is among the functions of the Task Force. State-wide planning has the potential of identifying areas where there are deficiencies.

D. Changes In Computer Technology. The rate of change in computer technology is a major factor to be considered by the Task Force. The rapid rate of change in the industry suggests that specific solutions are less desirable than frameworks to guide institutional and state decisions. For example, if Missouri had initiated state-level planning five years ago, the technology of the time may have favored the development of one large computer network. However, due to technological changes, the costs of computer hardware relative to the total costs of running campus computing facilities has decreased. Software and personnel costs are now higher relative to total computer costs.

The increased efficiency of small computers may have lessened the desirability of sharing time on large machines for states like Missouri where many institutions already have campus computing facilities. However, there are still many potentials for computer networks in a era when computer hardware is distributed rather than centralized in higher education. In fact, these technological developments may have increased the desirability of sharing software development costs for academic and administrative computing and personnel costs of maintaining these services.

E. Framework for Approving Requests for Campus Computer Equipment.

The computing study to be conducted by the Task Force, with the technical advice of the Computer Center Directors Council, will establish general guidelines for the future development of campus computing facilities. Carl Garrett, Office of Administration, Division of E.D.P. Coordination, emphasized this at the first Task Force meeting. Since the technology will undoubtedly change during the next five years, the Task Force should not attempt to suggest the types of machinery that campuses should possess. Rather its purposes are to recommend general guidelines for institutional planning in academic and administrative computing and for OA/EDP use in reviewing institutional plans and to identify overall strategies where appropriate. Specific machines will not be recommended, but

the computing capability available to higher education institutions in the state will be part of these deliberations. Each institution should, within these general guidelines, be able to determine the best way of meeting its computing needs, which might include sharing resources in some areas.

II. Work Plan for the Task Force. The Computer Policy Task Force is a policy recommending group. To formulate and recommend a policy framework for higher education computing in Missouri, the Task Force must consider the current status of computing, the establishment of state-wide objectives for future computer system development in the state, insitutional objectives for computing capacity development, alternative strategies for meeting these objectives, and priorities for future development.

A. Current Status of Computing in Missouri. The first step in developing a policy framework will be consideration of the state of development of computing in the state, which would provide data to compare with goals for future development. Fortunately, the data which may be made available to the Task Force by Dr. John Hamblen is an excellent resource on what computers presently exist in higher education in several states. As the Task Force generates questions about computing in Missouri, MDHE staff can review these data for answers and consult Dr. Hamblen for further analysis when necessary.

B. Computing Objectives Which Support Institutional Objectives. Institutional computing needs and objectives will be a second area to be considered by the Task Force. This should include identifying computing objectives held by institutions in the state; evaluating the appropriateness of these objectives relative to the state-wide objectives identified by the Task Force; and identifying those areas in which deficiencies exist. The Task Force will design a study of institutional needs that could be contracted to a consulting firm through a competitive bid.

C. State-wide Computing Objectives. A third part of the Task Force activities will be to recommend to the Missouri Coordinating Board for Higher Education (CBHE) a set of state-wide objectives for computing in higher education. These state-wide objectives will be used as a basis for evaluating institutional objectives. They will provide a broad framework for future development in the following areas: academic, including instruction, research, and libraries; administrative, including software and systems development; and public service, including computer services for schools and local government agencies. The state-wide objectives will not be merely the sum of the institutional objectives. Rather, they will likely suggest both extensions and limits to those that might be developed by the individual institutions.

D. Alternative Strategies. Another part of the Task Force's activities will be the consideration of alternative strategies for meeting state-wide and institutional computing objectives. A range of organizational alternatives will be considered, including the status quo, specialized networks providing academic or administrative computing services, and a general computer network. Networks as a possibility for Missouri can only be evaluated in the context of state-wide and institutional objectives. To assist the Task Force in their consideration of alternative strategies, directors of computing networks in other states will be invited to present their experiences and ideas about the future of higher education computing.

E. Priorities for Development. It will be up to the Task Force to recommend priorities to the CBHE about the future of computer development in Missouri. It should consider the basic necessities, additional developments that while not absolute necessities would, nevertheless, improve the quality of education in the state, and additional developments which may be of lesser priority. To accomplish this, the Task Force will have to examine all of the areas considered above.

F. Implementation. Since the Computer Policy Task Force will dissolve when the report is complete, it must consider the organizational mechanisms required for implementing their recommendations.

III. Tentative Time Schedule for Task Force Study.

A. December Meeting

1. Agenda

a. Visit to Illinois computing network.

b. Review of study plan.

c. Presentation on EDUCOM conference.

d. Discussion of state-wide study of institutional computing objectives and needs. The Task Force will also consider the type of consulting firms that might conduct the study.

e. Discussion of potential hardware strategies. Subgroup will be formed to evaluate the potential of alternatives for Missouri.

2. Between Meeting Activities

a. Task Force recommendations on the institutional study will be written into RFP specifications for bids from consulting firms. At a minimum the study should:

1. Assess the computing needs of public higher education institutions in Missouri; and

2. Assess the computing needs of public institutions in selected other states that have a history of state-wide planning (to gauge what the future needs of Missouri institutions are likely to be).

b. Task Force recommendations on state-wide objectives will be organized into a report that will be circulated to Task Force members prior to the January meeting.

c. Activate hardware strategies evaluation group.

B. January Meeting

1. Agenda

a. Approval of state-wide objectives for higher education computing.

b. Review of study plan; if bids have been received and possible vendor has been selected, then computing study plan will be submitted for Task Force approval.

c. Panel of experts on state-level computing services. (This will include individuals with experience with state-wide networks.)

d. Consideration of states to be visited by Task Force subcommittee. A limited number (2-4) of state visits will be arranged for subcommittee members during January and February.

2. Between Meeting Activities

a. Statement of approved state-wide objectives will be written and circulated to Task Force members.

b. During January and February the study of institutional computing needs will be conducted by the consulting firm.

c. Arrangements for site visits to states will be made soon after the December meeting and site visits will be conducted during January and February.

C. February Meeting

1. Agenda

a. Review of computing study results.

b. Consideration of institutional computing needs, possible minimum and maximum levels of development for institutions of different sizes and types, and priority areas for future development.

c. Presentation on the potentials for computer networking for academic and administrative computing.

2. Between Meeting Activities

a. Task Force recommendations on guidelines for considering institutional computing needs will be written into a report for the Task Force.

b. The final site visits to states will be conducted by subcommittee members and report summaries will be put into a report for the Task Force.

c. Based on the institutional study, the site visit reports, and Task Force recommendations, a list of alternative areas for future computer development will be formulated for Task Force consideration.

D. March Meeting

1. Agenda

a. Report on state visits and discussion of state level planning, organization, and management of computing resources.

b. Identification of areas for future development in Missouri higher education computing. Priorities for these areas will also be considered, as well as means of implementation.

c. Consideration of means of implementing Task Force plans. This should include consideration of the potentials and desirability of cooperative development of computing software and hardware in Missouri and the groups that should be formed to oversee implementation.

2. Between Meeting Activities

   A draft of the Task Force report will be written between meetings and circulated to Task Force members before the April meeting.

E. April Meeting

1. Review of draft Task Force report on state-wide objectives, institution needs, potentials for computer sharing, priorities for development, and consideration of means of implementation.

2. Consideration of need for additional Task Force meetings to review Task Force report.

Appendix D

Consultant Reports

1. Donald M. Norris, "An Assessment of Computing in Missouri and a Blueprint for the Future."

2. Louis T. Parker, "Task Force Recommendations."

D-2

An Assessment of Computing in Missouri and A Blueprint for the Future

Donald M. Norris, Consultant

In my role as one of the two consultants to the Missouri Computing Task Force, it has been my responsibility and privilege to provide the Task Force with assessments of the state of cooperative computing and of the sorts of cooperative ventures which might work in Missouri. In this regard, I have furnished advice on request at the Task Force meetings, and have prepared a number of background documents on the state of the art of statewide computer planning and on alternative strategies for cooperative computing. The purpose of this report is to venture a step beyond my previous functions and to offer some concrete recommendations for computing in the state of Missouri.

Before stating these recommendations, however, it is necessary to discuss the current environment in Missouri. I shall also discuss candidly the concerns and fears, some of which are quite legitimate, held by different groups of institutions. These fears and concerns, rather than technological constraints, are the factors which truly limit cooperative computing in Missouri.

It is likely that some members of the Task Force will take issue with my assessment of particular circumstances or the balance of relationships in the state. It is probable that many Task Force members will disagree with some of my recommendations for computing in Missouri. Not only is there a healthy level of disagreement over how best to increase computing power in the state, but there is a natural tendency to resist new approaches which promise both risks and new opportunities. However, it has been my experience that few states have been able substantially to expand their computing power without disagreement and some risk taking. Moreover, while I would be derelict in my duty if I failed to recognize the special environment in Missouri, I would be equally remiss if I merely parroted the conventional wisdom and failed to offer new ways of addressing old problems.

Current State of Computing and Networking in Missouri

While it is common for different types of institutions to have different types and levels of computing power, the disparity between individual institutions and groups of institutions is even greater in Missouri than in many other states. The University of Missouri System boasts relatively well developed administrative and academic computing capabilities. The regional state universities are far less developed and suffer in comparison relative to similar institutions in many other states. In addition to being under supported, some of the data processing systems in the regional state universities do not seem to be getting the most from their investment. The community colleges range from having no computing power and expertise to having reasonably well developed systems; the average computing capability in these institutions seems to be below that of many similar institutions in other Midwestern states. These observations are supported both by personal judgment and by the fact that the general level of computing expenditures in Missouri is lower than that at comparable institutions in other states.

Moreover, in evaluating the appropriateness of computing objectives and the extent to which these objectives were being met, many institutional respondents suggested that legitimate computing objectives were not being satisfied in the state. While the University of Missouri was viewed as doing a reasonably good job of meeting many of the legitimate objectives for computing, the two- and four-year institutions were seen as facing a substantial deficit of unfulfilled needs.

While computer networking is not as advanced in Missouri as in some other states, the University of Missouri System has established a rather extensive network which serves both its campuses and a number of other institutions, as well. This network is a valuable resource which can serve other institutions. Concurrent with the establishment of the Computing Task Force, the directors of major computing centers have been meeting to share ideas and provide the sort of information network which is very handy for established operations. However, institutions with little or no computing power have not been involved in these activities and badly need a mechanism by which their expertise may be enhanced.

The Atmosphere of Coordination and Review of Computing

The University of Missouri is endowed with "constitutional autonomy" and therefore is not required to participate in many of the normal review procedures in the state. What this really means is that the state can tell the University System how much money it is being appropriated, but not how to spend it. While the University of Missouri is understandably protective of this constitutional autonomy and is reticent to undertake activities which might call its constitutional autonomy into question, the University has been extremely forthcoming in discussing possible additional cooperative ventures and the extension of its network. It is interesting that in the three major Midwestern states having constitutionally granted autonomy - Missouri, Minnesota, and Michigan - substantial networking efforts have grown, either at the major University's initiative or in cooperation with a state-level activity.

While the University of Missouri is spared from mandatory computing review by its constitutional autonomy, the community colleges have escaped uniform, intensive scrutiny by virtue of their relatively limited acquisitions and their local base of support. This means that the review of hardware requests has focused almost exclusively on the regional state universities. This particular point disturbs these institutions, quite understandably, since they feel they are under special observation. This condition has been exacerbated by the increased activity of Carl Garrettt, Director of the Division of EDP Coordination, Office of Administration, who has taken a more active role in reviewing - and denying - requests for new hardware acquisitions. Moreover, the creation of this Computing Policy Task Force by the Department of Higher Education has been viewed by some as being directed primarily at the regional state universities.

This does not mean that only the institutions are faced with coordination problems. Both the Division of EDP Coordination and the Department of Higher Education find themselves in awkward positions: Both want to permit and encourage legitimate expansion of computing power in the state, but realize that to do so, they must insure that growth is accomplished as efficiently and effectively as possible. Merely increasing the institutions' funding and giving them authorization to purchase new

equipment would not be palatable without accompanying measures to assure that the resulting growth was the most efficacious possible.

The net result of these conditions has been to strengthen the barriers to cooperation which normally exist among and between different groups of institutions. While the University of Missouri provides networking capabilities to other institutions, it would not be anxious to expand its networking functions nor to participate in other cooperative activities which might raise the spectre of increased "statewide coordination"; jeopardize its constitutional autonomy; impose its system on other institutions, at the risk of a backlash of ill-will; or result in deteriorating service to its own users. The regional state universities, on the other hand, are concerned by the prospects of being dominated or swallowed up by the University of Missouri network and are highly protective of the computing resources which they have accumulated, even though those resources are inadequate to their emerging needs. While some of the two-year institutions with existing computing capabilities are somewhat defensive, many seem to be willing to attempt new approaches in order materially to increase their computing power. On the other hand, the Division of EDP Coordination and the Department of Higher Education need more than ever to offer evidence of planned, cooperative growth, if they are to argue for increased funding on behalf of the institutions.

Addressing the Problem with a Facilitating Organization

Despite these conditions, some members of the Computing Policy Task Force have continually contended that no problem existed or that all that was needed was a healthy injection of new resources, to be utilized by the institutions as they saw fit. But such a laissez faire approach has been unsuccessful in the past in Missouri in encouraging optimal development of computing and is unacceptable politically in today's environment in Missouri or in any state. The institutions must realize that from now on they can expect to have computing acquisitions scrutinized carefully by some party in state government; moreover, for the DHE and OA forcefully to support substantial increases in computing power, the institutions must

demonstrate a good faith effort toward coordinated, efficient development. If they fail to provide such a quid pro quo, the institutions will maintain their relative independence, but at the price of maintaining the current status quo of computing mediocrity, as well.

In my judgment, a satisfactory level of cooperative and coordinated development can be provided without jeopardizing the constitutional autonomy of the University of Missouri System, subjugating the regional state universities to domination, or ensnarling the institutions in a cumbersome layer of bureaucratic procedures. Further, sufficient assurances of efficient development cannot be provided solely by mechanisms such as making available to other institutions the services and facilities of the University of Missouri network or utilizing the Council of Computer Center Directors as a planning and idea sharing group. A facilitating mechanism is needed that will be more comprehensive than existing efforts and will especially reach out to embrace institutions that are relative computing have-nots. The means must be provided not just to make facilities and services available to new users, but affirmatively to educate new users and advance them in sophistication. Such functions cannot be achieved solely through voluntary associations of computer users or directors who are burdened with their own operational concerns.

The document, "Alternative Strategies for Computing" suggested the following possible functions for a facilitating organization in Missouri

1. Provide leadership for the state in computing developments.
2. Serve as information clearinghouse.
3. Provide training and staff development.
4. Function as computing advocate and raise the consciousness of underserved institutions.
5. Direct planning for computing in Missouri higher education and measure achievement of statewide goals and objectives for computing.
6. Assist in preparation of specifications, equipment selection and achievement of favorable terms of lease/purchase.
7. Provide software development and instructional timesharing service, if conditions warrant.

These functions still make sense for a mature, fully developed facilitating network, although such a network could be successful performing only functions 1, 2, 3, 4, and perhaps 5. It may make sense for such an organization to begin modestly, assuming other functions if it proves itself worthy. However, the institutions should not be deluded into thinking that if the facilitating network did not review acquisition requests and coordinate development, these functions would not be performed. The OA and/or DHE can be expected to be very active in such functions, in any event.

As stated in "Alternative Strategies for Computing" a facilitating organization is greater than the sum of its parts. Even if the individual institutions or other groups could perform some facilitating functions, it would make sense to have a more comprehensive, full-time organization dedicated to these activities. The facilitating organization would not detrimentally duplicate existing efforts; it would complement them. It would not add an additional level of bureaucracy, but a parallel mechanism for assistance. If at some point in the future the facilitating network were expanded to review hardware requests and coordinate development, it would only do so if the organizations performing those functions ceded them to the facilitating organization.

In many states which have engaged in statewide planning for educational computing, the institutions have taken the leadership in establishing cooperative ventures congruent with the conditions in the state. Rather than being motivated by sheer altruism, the institutions generally were also guided by three pragmatic considerations. First, if they did not give evidence of working together, they could not get substantial increases in computing power. Second, state agencies and legislatures were interested in evidence of good faith efforts toward cooperation rather than a particular cooperative outcome. Third, if the institutions did not take the lead in devising appropriate cooperative ventures, the coordinating agency or another state agency would probably establish such ventures, using its own guidelines. Given these considerations, institutions were willing to take some calculated risks to avert the certainty of frustrated ambitions, inadequate resources, and inappropriate measures.

In my judgment, similar conditions exist in Missouri. The best way for institutions to increase their computing power is to demonstrate good faith efforts in support of a facilitating mechanism that will protect both institutional and public interests. This is also their best insurance that the institutions, rather than the DHE and/or OA, will be the dominant force in the facilitating organization.

There are a number of other comments in the following appendix regarding the possible composition and placement of a facilitating organization. However, I believe such discussion is fruitless unless and until the institutions through their representatives on the Computing Policy Task Force demonstrate a commitment to reasonable cooperative efforts. Much effort has been made to eliminate from consideration those overly ambitious, strictly controlled networking options that would be totally inappropriate in Missouri. What remains - some form of facilitating organization - should be viewed as a reasonable instrument through which the institutions can both serve their interests and fulfill the legitimate demands of the state for the most effective and efficient use of resources.

Appendix

Proposed Characteristics of the Missouri Facilitating Organization

The Missouri Facilitating Organization (MFO) should be characterized by the following points:

- Staff should consist of an Executive Director, Assistant Director (possibly on loan from institutions) and a Secretary
- Annual budget should be approximately $100,000 (with $65-70K for salaries, remainder for travel, workshops, etc.)
- Ultimately, budget will come partly from the state as a line item, partly from institutional subscriptions (by prior agreement, not level of usage)
- Governed by a Policy Board, which would essentially be a continuation of the Computing Policy Task Force (although with modified membership)
- Supported by Technical Advisory Group of Computer Center Directors and Major Users
- Either incorporated as an independent legal body, or reports to Commissioner, Department of Higher Education
- Performs functions 1-5, with planning performed in conjunction with Policy Board
- Physically located in Columbia, in proximity to University of Missouri Network
- Comes on-line operationally in 1980-81.

Staff Composition and Budget

The facilitating organization should be led by an Executive Director, who should be a substantial computing professional, capable of holding his/her own with the Computing Center Directors. The Executive Director should have institutional experience, but need not be a technical virtuoso. He/she should exhibit demonstrated skills in computing policy and management and should possess skills in communication and persuasion.

The Executive Director should be supported by an Assistant Director. It might be attractive for this individual to be on loan from an institution for a year. This individual would acquire experience in management and networking and would support the Executive Director in a variety of technical matters. Other computing professionals throughout the state could be utilized by the facilitating organization in staging workshops and similar activities.

The MFO would also employ a full-time secretary to support the Executive Director, Assistant Director and other computing professionals working with the MFO on special projects.

It would probably be necessary to pay the Executive Director in the neighborhood of $35,000 - $40,000 (1980 money), the Assistant Director $20,000 - $25,000 and the Secretary $10,000. This would yield a salaries budget of $65,000 - $75,000. In addition, the MFO should have a substantial travel and operations budget so that its professional staff could attend professional meetings and in order to support workshops and "circuit riding" around the state. The total budget for 1980-81 would be in the neighborhood of $100,000.

This is a barebones estimate. It might be desirable, if funding were available, to employ two Assistant Directors, rather than one, or an additional lower level professional person to assist in technical matters or to help with the newsletter, documentation, and staging of programs that would be important tasks of the MFO.

Ultimately, the budget should come from two sources: one-half as a line item directly from the state appropriation (probably <u>not</u> as part of the DHE appropriation) , and one-half from institutional subscription. These subscripti should not be levied evenly for every institution, nor should they be based on current computing expenditures, since underdeveloped institutions stand to benefit most from the MFO. Some combination of size and complexity might be used to devise a formula for determining institutional contributions. These subscriptions would not be sufficiently large to tax most institutions and would create a climate supportive of increased computing appropriations, so the net impact would be positive, in terms of funding.

Although it ultimately would be desirable to have the MFO funded by a combinatio of state and institutional contributions, it might be necessary initially to support the MFO entirely by state funding. This would enable the MFO to establish a track record of successful service before it would be dependent on institutional funding. Moreover, this funding would need to be by prior agreement, to insure a firm resource base for planning purposes. At least initially, institutional contributions might need to be mandatory.

Governance and Organizational Placement

The MFO would be governed by a Policy Board, which would essentially be a continuation in spirit of the Computing Policy Task Force, although the membership would undoubtedly change somewhat. This group would be responsible for guiding the direction of the MFO and for participating in statewide goals/needs, assessment and planning for computing in postsecondary education in Missouri. The Policy Board would be responsible for approving major personnel decisions and for providing the Executive Director of the MFO with direction as to the goals and policies of the organization.

The MFO would also be supported by a Technical Advisory Group composed of Computer Center Directors and other major users. While the Advisory Group may have a representative on the Policy Board, it would not generally deal with policy, but with more technical matters and evaluation of quality of services provided by the facilitating organization.

The question of the legal standing of the facilitating organization needs to be determined within the statutes of Missouri. In many ways, if would be favorable for the MFO to serve as an independent legal body, answerable only to its supporters, through the Policy Board, and the Legislature. However, it would be expedient if the MFO could reduce its overhead by reporting to an existing agency, and in this case it should report to the Commissioner of the DHE. Generally, I do not believe the MFO should be a part of the Office of Administration; if it must have an agency home, the DHE is probably more appropriate.

Funtional Duties

The MFO should begin by performing five primary functions:

- Provide leadership for the state in computing developments.
- Serve as information clearinghouse
- Provide training and staff development
- Function as computing advocate and raise the consciousness of underserved institutions.
- Direct planning for computing in Missouri higher education and measure achievement of statewide goals and objectives for computing.

The fifth duty- directing planning for computing in Missouri higher education and measuring achievement of statewide goals and objectives - should be performed with the active participation of the Policy Board.

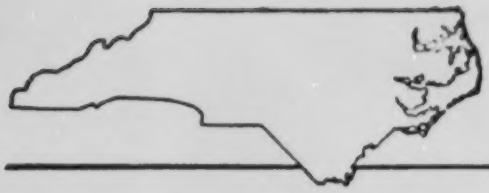
The emphasis should be placed on the MFO's roles as institutional supporter, not coordinating mechanism. While the MFO will hopefully create the mechanism for institutions efficiently and effectively to enhance their computing power through cooperation, it should not be viewed as a vehicle for control. Indeed, it is likely that an effective set of facilitating functions would create an atmosphere of efficient development that would reduce the current emphasis on control of hardware acquisitions.

Proximate to the University of Missouri

In order for the staff of the facilitating organization to keep current professionally and up-to-date with developments in the Missouri network, the staff should be located in Columbia or Jefferson City. While it is important that the facilitating organization not appear to be part of the University of Missouri, it is critical to tap the expertise and facilities of the University of Missouri network. If carefully arranged, this will benefit all parties.

Starting Time

The ground work should be laid in the coming year so that this facilitating organization could begin functioning in the 1980-81 academic year.



NORTH CAROLINA
EDUCATIONAL COMPUTING SERVICE
Box 12035, Research Triangle Park, North Carolina 27709
Area Code 919, 549-0671

JUN 8 1979

June 4, 1979

MEMORANDUM

TO: T. Michael Elliott

FROM: Louis T. Parker LP

SUBJECT: Task Force Recommendations

ORGANIZATIONAL CONSIDERATIONS

The principal assumption underlying my recommendations is that higher education in Missouri could benefit substantially from cooperative action and the sharing of computer resources, especially personnel (technical leadership and know-how). The present state of computer utilization at many of the institutions, vis-a-vis the rapidly expanding technology, point to a need for new approaches to the development of computing. These approaches involve the establishment of some ongoing mechanism for cooperative action, so the formation of a "facilitating organization" is recommended. The benefits which would be most immediate and obvious relate to the developing ("have not") institutions. However, I definitely believe benefits would gradually extend to include all colleges and universities in Missouri (not to suggest that they will all benefit equally, of course).

The minimal step would be to establish a coordinating committee with broad representation from the institutions. Such a group could, to a limited extent, identify opportunities for cooperation and resource sharing and promote such activities. However, I do not believe that a committee alone would be sufficient. At least a director and small support staff will be required if substantial

progress is to be made--results can be expected to be proportional to the amount of time devoted to the effort. The needs are too great and the opportunities too extensive for a committee of people trying to do this on top of other, full time responsibilities.

There will, of course, need to be one or more committees associated with the new organization. The director probably should report to a board consisting of representatives from the Department of Higher Education, the institutions (with at least all categories of institutions represented) and other agencies and organizations as appropriate. The new entity would be essentially a facilitating organization as described in the paper by Don Norris on alternative strategies. To achieve neutrality (with respect to the institutions), it probably should be affiliated in some manner with the Department of Higher Education.

It is not clear that establishing a not-for-profit corporation is worth the added effort and overhead, at least initially. That might be very appropriate, however, after the new organization had matured and its activities had stabilized. In this way the value of incorporation would be better understood vis-a-vis the actual activities underway, and benefits could be weighed against the effort involved and any perceived disadvantages. If employees of the central organization were not (directly) on the corporation's own payroll, but could participate in the fringe benefit program of some other agency, then matters might be simplified considerably. This was the approach taken by the Illinois Educational Consortium and Dr. Michael Sher, President of IEC, would be an excellent reference on this point.* Also, if the proposed facilitating organization does not actually sell services, this might avoid some overhead associated with incorporation (as regards IRS regulations, for example). The answers to some of the questions relating to organizational structure are not obvious, and careful consideration will be required.

*With respect to IEC, it should be noted that incorporation was essential in terms of their early activities. The proposed organization in Missouri would not necessarily be performing the same kinds of functions (but might wish to get into similar activities at some later time).

FUNCTIONS OF THE NEW ORGANIZATION

A number of possibilities for services that a facilitating organization could provide in Missouri have been described in the paper on alternative strategies and will generally be listed here without elaboration. Appropriate functions include providing leadership to develop computer utilization, maintaining contact with national resource sharing organizations, serving as an information clearinghouse, bringing about the sharing of expertise which already exists at the institutions, providing training and staff development, performing planning functions, serving as a computing advocate, assisting in equipment specification and selection, arranging for bulk purchases and volume discounts where appropriate, and promoting the sharing of software through joint development and purchase.

Direct provision of service, such as an instructional time-sharing service, should not be ruled out as a possibility; this could be valuable to institutions presently without adequate instructional computing capability. That, however, would not be the principal justification for the new organization. It can be justified solely on the basis of facilitating functions. Such services would, however, include arranging, where appropriate, for certain institutions with established computing facilities to serve as suppliers to other institutions which could benefit from such access. The central organization could serve as the representative of the customer institutions to insure adequate provisions were made for user services, fair pricing, etc. I specifically do not recommend the installation of an extensive telecommunications network with elaborate provisions for hardware access unless adequate provision is made for the personnel support and user services that would guarantee significant and effective use of network facilities. Successful networking requires more than telecommunications equipment and such facilities are too expensive to maintain if not effectively utilized.

In general, the new facilitating organization would be designed more for the sharing of personnel and software than computer hardware. There are several possibilities for software sharing:

(1) Software development by a central staff. Since a small staff is proposed, I believe this approach is unlikely.

(2) Arrangements for institutional staff to develop software for joint use, with representatives of several institutions involved in the specification process (and possible central funding).

(3) Negotiating favorable discount arrangements with commercial software suppliers for administrative systems that would be installed at several campuses.

(4) Serving as a software clearinghouse for instructional applications obtained from CONDUIT and various other sources.

The best approach will depend on the particular requirement and on various other factors such as the availability of suitable packages from commercial suppliers. The important advantage of the facilitating organization is that all reasonable alternatives could be explored and cooperative efforts could be pursued where appropriate. (This is unlikely to come about to a significant degree without a central staff).

One of the most important functions of the facilitating organization would be to provide training for faculty and staff, especially those of the smaller institutions. In the instructional area, there are needs for training in computing techniques as applied to specific academic disciplines as well as obvious requirements for training in programming and computer science. Resource persons from institutions already heavily involved in academic computing should be utilized in this effort. Thus, the central staff need not have expertise in a variety of disciplines, since the objective can be accomplished by organizing workshops and arranging for qualified institutional personnel to make presentations. Equally important, however, is the availability of follow-up technical consultation and general

personnel support; this would have to be provided by the central organization staff. Without some new organization providing such functions, I do not see how the less developed institutions can be rapidly brought up to the present state-of-the-art in academic computing. Certainly the problem is not solved by simply placing computers and/or terminals at all of the institutions.

Since a cooperative approach toward developing computer-based applications utilizes institutional faculty and staff expertise, the impact should far exceed the sharing of central staff technical know-how (although that is obviously an important foundation). The director must make a concerted effort to amplify the expertise of his own staff by identifying and utilizing resource persons from throughout higher education in Missouri. The technology and its applications are expanding so rapidly that no one person can stay abreast of all developments. The facilitating organization will have to draw upon the resources of the member institutions because it will not be possible to keep adding specialists in communications, microcomputers, administrative data processing, etc. Text processing is a good example of a rapidly growing area in which one or more institutions might take the lead; the function of the facilitating organization would be to insure that their experience was shared statewide, and that opportunities were not overlooked for volume discounts on equipment, joint development of software, etc.

In the academic area, faculty workshops provide and excellent opportunity for idea exchange between peers in a given discipline, and such opportunities might not exist without the type of cooperative effort proposed. With respect to larger institutions, it is <u>not</u> true that heavy computer use (specifically in research) implies that the computer is being used widely at the classroom level. It is quite common for a professor to say that, although he uses the computer frequently in his research, he has never developed an application in undergraduate instruction. Often, they are eager to get ideas from colleagues. A cooperative effort which draws upon the faculties of all institutions in the state can identify key people who are leaders in instructional computer use--and who are not necessarily at the research-oriented institutions.

Faculty members who have utilized computers in research can therefore benefit from the work that colleagues have done in the classroom, and they often wish to take advantage of already-developed instructional software.

Clearly, much of the success of a new facilitating organization will depend upon having the right type of person as director. It may prove difficult to attract the calibre of person needed for an organization of this type (few states have obtained experience in this regard). The search for a director would probably require more time and effort than recruiting someone to manage a traditional computer center or network. The new organization will need to prove its worth and to win the respect of the institutions it is designed to serve. In spite of inherent difficulties, however, I believe the effort should be attempted, since the potential payoff is very great.

HARDWARE/SOFTWARE STRATEGIES

Somewhat independent of the question of establishing a new central organization are the stragegies to be followed in acquiring computing hardware and software. If the proposed solution were a central facility (star network) then, of course, the two would be intimately tied together. With a facilitating organization, a number of different hardware/software strategies are possible, and different strategies will probably be adopted to meet different requirements. The significance of the facilitating organization is that it will make possible the identification and exploration of alternatives involving cooperative action which would otherwise never be considered. For the smaller insitutions, some of these options may make the difference between having or not having a certain capability (due to cost considerations). This may be true, for example, in the area of on-line administrative applications.

The following are examples of specific hardware/software strategies which might be considered:

(1) Acquisition from commercial vendors of complete "turnkey" systems for administrative data processing.

With central planning it might be possible to reduce substantially the price, by having similar systems installed on several campuses (most likely the smaller institutions).

(2) Standard hardware configurations for a set of similar institutions, specifically designed to enable common administrative software packages (centralized approach to software but decentralized hardware).

(3) Negotiation of bulk purchase agreements for several different types of terminals meeting specifications which were jointly agreed upon. (This would not restrict users who had special requirements for terminals with different specifications).

(4) Centralized approach to microcomputers for instruction. Joint development of specifications could lead to one or more standard configurations and statewide contracts, thus enabling centralized training, support and software distribution. The approach taken by MECC is a good example of centralized instructional software development with decentralized hardware. Without such provision for software and staff support, present-day microcomputer hardware might well be unsatisfactory for many institutions. A strategy such as this recognizes the increasing desirability of sharing personnel and software costs, while distributing relatively inexpensive hardware.

(5) Central clearinghouse and distribution center for instructional software, irrespective of institutional equipment (specifically not limited to microcomputers). This approach would be similar to that taken by CONDUIT, relying on standard versions of widely-used languages such as FORTRAN and BASIC. Membership in CONDUIT would be an important part of such a strategy, but instructional software could be obtained from many other sources, including institutions in

Missouri. CAI courseware should also be documented, maintained and distributed in this manner, together with utilities which facilitate the process of authoring materials.

The overall approach being recommended allows considerable flexibility. Different strategies can, and should, be selected depending on the nature of the requirement and the particular subset of institutions to be served. Although certain strategies are not contingent upon the existence of some new organization, it seems clear that a central staff could do much to broaden the range of available alternatives, provide technical and administrative support, and generally facilitate cooperative action where appropriate.

Appendix E

REFERENCES MADE AVAILABLE TO COMPUTER POLICY TASK FORCE

Albright, A.D. and Braun, T.G., Kentucky and Its Educational Computing Network Frankfort, Kentucky: Commonwealth of Kentucky Council on Public Higher Education, April, 1976.

Ames, R.G. and Carpino, S., "Advances and Declines in Computer Advocacy", EDUCOM. Vol. 12, No. 4, 1977, pp. 7-11.

Aupperle, E.M. and Davis, D.C., "The Merit Computer Network," EDUCOM, Vol. 13, No. 1, 1978, pp. 8-19.

Boche, R.E. "Designs For Preserving Benefits in Information Systems Exchange," Cause/Effect, Vol. 1, No. 5, Sept. 1978.

EDUCOM, EDUNET: A National Computing Network for Higher Education and Research. Princeton, NJ: EDUCOM, 1979.

Elliott, T.M., "Computing in Missouri Higher Education: Policies/Politics/Problems/Potential", Jefferson City: MDHE, 1978.

EDUCOM Consulting Group: Computing in Colorado Higher Education--A Review with Recommendations. Princeton, NJ, EDUCOM, 1978.

Emery, J.C., "The Coming Challenge of Campus Computation," EDUCOM. Vol. 12, No. 4, 1977, pp. 12-18.

Fife, D.W., "Considering Networking: Network Management for Expanded Resource Use," Facts and Futures, Princton, NJ: EDUCOM, 1973, pp. 55-61.

Haugo, J.E., "MECC: A Five Year Progress Report", Minneapolis, Minnesota: MECC, 1978.

Heydinger, R.B. and Norris, D.M., Cooperative Computing: A Process Prospective on Planning and Implementation, Princeton, NJ, EDUCOM, 1977, 1977, EDUCOM Monograph series, No. 1., Chapters 1, 6, and 7. pp. 1-14, 71-114.

Holms, F.W., "IRM: Organizing for the Office of the Future," Journal of Systems Management, January, 1979. pp. 24-31.

Katzan, H., Information Technology: The Human Use of Computers., New York: Petrocelli Books, 1974. Part I, pp. 3-126.

Levien, R.E., The Emerging Technology: Institutional Uses of the Computer in Higher Education, New York: McGraw-Hill, 1972, Chapter 17, pp. 543-562.

Mossmann, C., Academic Computing in Service, San Francisco: Jossey-Bass, 1973, Chapters 3, 4 and 11. pp. 25-55; 146-161.

Mossmann, C., Evaluating Instructional Computing: Measuring Needs and Resources in Higher Education, Princton, NJ: EDUCOM, 1977. No. 2, EDUCOM Monograph Series, 1977.

Norby, G.L., "Minicomputers Acquisition Policy: A Process and A Conclusion." EDUCOM, Vol. 13, No. 2, 1978. pp. 2-8.

O'Halloran, C., "The White House Conference", Show-Me Libraries, September, 1978.

Parker, L. T., "A Curriculum Applications Library with Multiple Support Levels and Faculty Review." Presented at the 6th Annual Seminar for Directors of Academic Computing, August 18-21, 1975.

Parker, L.T. and Denk, J.R., "A Network Model for Delivering Computer Power and Curriculum Enhancement for Higher Education: The North Carolina Educational Computing Service. EDUCOM Bulletin, Spring, 1974.

Reid-Green, K.S., "A Short History of Computing," Byte, July 1978, pp. 84-94.

Shomper, C., "An Overview of Proposed 1979-84 WVNET Computer Plan", Morgantown, WV; WVNET, 1978.

Smith, L. S., "A Telecommunications Primer for College Presidents Part I; The Technologies Defined." Planning For Higher Education 7:3 (Dec. 1978). 7-11.

Smith, L. S., "A Telecommunications Primer for College Presidents: Part II. Implications and Issues, Planning For Higher Education, 7:3 (Dec. 1978). 16-23.

Sugarman, R., "A Second Chance for Computer-Aided Instruction: What Networking Promised but Didn't Deliver May Be Developed at the Local Level As Hardware Costs Drop?" IEEE Spectrum, August 1978. pp. 29-37.

Withington, F.G., "IBM's Future Large Computers" Datamation, July, 1978, pp. 115-120.

Appendix F

Survey Instruments

1. Letter of Transmittal
2. Update of Inventory of Computers
3. Management Systems Development Survey
4. State-Wide Computing Objectives Assessment Questionnaire
5. Student Access to Computing Resources

MISSOURI DEPARTMENT
OF HIGHER EDUCATION
600 CLARK AVENUE
JEFFERSON CITY, MISSOURI 65101
314/751-2361

BRUCE ROBERTSON
COMMISSIONER

TO: Presidents of Public Colleges

FROM: T. Michael Elliott

DATE: February 9, 1979

SUBJECT: Computer Policy Task Force Survey

As part of its on-going study of computing in Missouri higher education, the Computer Policy Task Force is conducting a survey of all public institutions in the state. The purpose of the Task Force is to develop a set of policy recommendations for the Coordinating Board and the Office of Administration that will improve the quality and condition of higher education computing including efficiency. The enclosed instruments are designed to gather information that the Task Force will need for its deliberations.

Five questionnaires are enclosed. Although the size of this request may seem imposing, the questionnaires have been designed to gather information that is readily available. Three of the questionnaires are to be filled out by the computer center directors. The remaining two are intended for yourself and for the chief academic officer (dean, vice president or provost). These are designed to gather <u>your opinions</u> about future directions for computing at your institution.

We request that completed questionnaires be returned to the Department of Higher Education <u>no later than February 26</u>. This is the last possible date to gather this information and report on it before the March meeting of the Task Force. This means that they should be mailed by February 23. Thank you in advance for your cooperation.

TME:EPS:ss

Enclosures

Update of Inventory of Computer's for Missouri Higher Education

Form 1: Expenditure, Sources of Income, Staff and Computers

(To be completed by Computer Center Directors)

The Missouri Department of Higher Education is requesting that public higher institutions in the state update Form 1 of the Computer Inventory conducted last in 1976 by Dr. John Hamblen, University of Missouri-Rolla. Three different items are attached: the information reported by your institution in the last survey (unless the survey was not returned), a blank form to be completed with 1977-78 information, and a set of instructions and definitions for Form 1. In order to update this form we request that you make the following enteries on the enclosed blank form.

1. Update all income and expenditure information using 1977-78 as the base year instead of 1975-76.

2. The portions of Form 1 dealing with use of off-campus facilities (line 2, columns 65-73; line 3, columns 41-52, and line 4, columns 43-58) should be completed. In many cases, this data was not included in the 1975-76 survey.

3. For lines 6 through 13, which provide data on the actual computer inventory, use December 31, 1978 as the last installation date for computer reported on this form.

4. Please indicate in a separate statement if your institution has installed or entered into a lease or purchase contract for a new machine since December 31, 1978.

Institution_____ Date_____

Computed by_____ Title_____

MANAGEMENT SYSTEMS DEVELOPMENT SURVEY

(To be completed by Chief Administrator
of Administrative Data Processing)

Forward

Most universities and colleges have developed their own management systems utilizing computing equipment. Many of these schools now find themselves with requirements to substantially revise their computer systems while concurrently maintaining existing systems. This need has led many schools to consider acquisition of systems developed externally that are readily implemented in a variety of college environments. This survey is designed to assess the similarity of management system development needs among Missouri universities and colleges. If such common needs exist, a basis may exist to negotiate a vendor contract for multiple installations that would reduce overall cost to each participating institution or establish voluntary mechanisms for sharing developmental efforts. Your cooperation in completing this survey and your suggestions for pooling resources to meet common needs will be appreciated.

Institution _____ Date _____

Completed by _____ Title _____

COMMENTS:

I. ADMINISTRATIVE COMPUTING INVENTORY

INSTRUCTIONS: Answer Yes or No to Part A. For Part B check the appropriate blanks to indicate the current status of the following systems. For Part C indicate "B" for batch processing, "O" for on-line processing or "C" for combined batch and on-line processing.

System Description	PART A: Is Computerization Relevant to Your Institution Yes - No	PART B: Not in Existence or Manual	PART B: Combined Manual and Computer System	PART B: Under Consideration for Computer Development	PART B: Under Development or Modification for Computer	PART B: Computer System in Production	PART C: Batch or On-Line
A. PLANNING, MANAGEMENT & INSTITUTIONAL RESEARCH							
1) Budget Forecasting							
2) Budget Preparation							
3) Budget Analysis							
4) Budget Position Control							
5) Institutional Cost Studies							
6) Faculty Salary Analysis							
7) Support Staff Salary Analysis							
8) Faculty Activity Analysis							
9) Support Staff Activity Analysis							
10) Induced Course Load Matrix Analysis							
11) Resource Requirements Modeling							
12) Student Flow Modeling							
13) Long Range Planning							
14) Enrollment Forecasting							
15) HEGIS Reporting							
16) DHE Reporting							
17) Data Element Dictionary							
18) Institutional Coding Structures							
B. FINANCIAL MANAGEMENT APPLICATIONS							
1) General Fund Ledger							
2) General Fund Expenditure Accounting							
3) Departmental Expenditure Accounting							
4) General Accounts Receivable							
5) Student Accounts Receivable							
6) Accounts Payable							
7) Payroll							
8) Employee Benefit Accounting							
9) Retirement System Accounting							
10) Bank Account Reconciliation							

F-5

System Description	PART A Is Computerization Relevant to Your Institution Yes - No	PART B Not in Existence or Manual	Combined Manual and Computer System	Under Consideration for Computer Development	Under Development or Modification for Computer	Computer System in Production	PART C Batch or On-Line
B. FINANCIAL MANAGEMENT APPLICATIONS (Continued)							
11) Cash Flow Projection							
12) Investment Records							
13) Investment Evaluation							
14) Grant & Contract Administration							
15) Research Project Accounting							
16) Research Proposal Monitoring							
17) Financial Aid Accounting							
18) Tuition and Fee Accounting							
19) Residence Hall Accounting							
20) Stores Accounting							
21) Telephone Accounting							
C. GENERAL ADMINISTRATIVE SERVICE APPLICATIONS							
1) Facilities Inventory (Space)							
2) Facilities Utilization Analysis (Space)							
3) Classroom Utilization Analysis							
4) Personnel Records							
5) Personnel Evaluation							
6) Personnel Placement							
7) HEW Compliance Reporting							
8) Staff Ethnic Group Reporting							
9) Civil Service Position Records							
D. AUXILIARY SERVICE APPLICATIONS							
1) Faculty/Staff Directory							
2) Faculty Club Billing							
3) Residence Hall Room Assignment							
4) Student Directory Preparation							
5) Student Housing Reports							
6) Food Service Menu Planning & Inventory							
7) Bookstore Inventory & Operations							

F-6

System Description	PART A: Is Computerization Relevant to Your Institution Yes - No	PART B: Not in Existence or Manual	PART B: Combined Manual and Computer System	PART B: Under Consideration for Computer Development	PART B: Under Development or Modification for Computer	PART B: Computer System in Production	PART C: Batch or On-Line
E. LOGISTICS & RELATED SERVICES							
1) Purchase Order Follow-up							
2) Purchasing Information System							
3) Vendor Information System							
4) Stores Inventory							
5) Office Machine Repair Control							
6) Equipment Inventory							
7) Automobile Registration							
8) Parking Lot Space Assignment							
9) Traffic Violation Records							
10) Crime Reporting							
11) Car Pool Matching							
12) Motor Pool Records							
F. PHYSICAL PLANT OPERATIONS							
1) Physical Plant Accounting							
2) Physical Plant Job Scheduling							
3) Building Maintenance Costs							
4) Equipment Preventative Maintenance							
5) Key Inventory							
G. ADMISSIONS & RECORDS APPLICATIONS							
1) Undergraduate Admissions Processing							
2) Graduate Admissions Processing							
3) High School Testing Records							
4) Course Master Records (Catalog)							
5) Schedule of Classes Preparation							
6) Student Class Scheduling							
7) Tuition & Fee Assessment							
8) Student Registration Processing							
9) Class Rosters							
10) Term Student Records & Reports							
11) Course Add/Drop Processing							
12) Enrollment Reporting							

System Description	PART A: Is Computerization Relevant to Your Institution Yes - No	PART B: Not in Existence or Manual	PART B: Combined Manual and Computer System	PART B: Under Consideration for Computer Development	PART B: Under Development or Modification for Computer	PART B: Computer System in Production	PART C: Batch or On-Line
G. ADMISSIONS & RECORDS APPLICATIONS (Continued)							
13) Enrollment Statistics							
14) Student Ethnic Group Reporting							
15) Term Grade Reporting							
16) Honors Program Records							
17) Student Transcript Master Records							
18) Degree Requirements Evaluation							
19) Correspondence Course Records							
H. FINANCIAL AID ADMINISTRATION							
1) Financial Aid Evaluation							
2) Financial Aid Awards							
3) Student Employment Records							
4) Work Study Records							
I. LIBRARY APPLICATIONS							
1) Acquisitions							
2) Cataloging							
3) Card & Material Preparation Control							
4) Circulation Control							
5) Serials Holdings							
6) Bibliographical Search Service							
7) Fugitive (Ephemeral) Material Indexing							
8) Educational Media Services							
J. OTHER ADMINISTRATIVE APPLICATIONS							
1) Alumni Records							
2) Foundation & Gift Records							
3) Test Scoring & Analysis							
4) Curriculum Planning							
5) Teacher Evaluation							
6) Teacher Placement							

System Description	PART A Is Computerization Relevant to Your Institution Yes - No	PART B Not in Existence or Manual	Combined Manual and Computer System	Under Consideration for Computer Development	Under Development or Modification for Computer	Computer System in Production	PART C Batch or On-Line
J. OTHER ADMINISTRATIVE APPLICATIONS (Continued)							
7) Fraternity/Sorority Rush Records							
8) Student Counseling Records							
9) Student Psychological Testing							
10) Athletic Event Ticket System							
K. HOSPITAL APPLICATIONS (To be completed by UMKC and UMC only)							
1) Patient Registration/Admissions							
2) Hospital Census							
3) Medical Records							
4) Appointments & Scheduling							
5) Central Supply Inventory							
6) Communications & Order Entry							
7) Dietary/Food Service							
8) Housekeeping							
9) Laboratory Information System							
10) Radiology Information System							
11) Pharmacy Information System							
12) Nursing Station Support System							
13) Physician Support System							
14) Patient Billing/Accounts Receivable							
15) Hospital Financial Information System							

147

II. DEVELOPMENT PRIORITIES

A. For the above listed undeveloped administrative systems, list the five most important priorities for development by your institution.

1. _____

2. _____

3. _____

4. _____

5. _____

B. For each system listed above, please indicate the single most crucial limiting factor that prevents implementation (i.e., personnel, disk space, main memory, money, etc.)

1. _____

2. _____

3. _____

4. _____

5. _____

C. Overall, what additional computing resources are most needed by your institution for administrative data processing (main memory, CPU, disk space, personnel, etc.)

_____

_____

_____

D. Has your institution obtained any of the above listed administrative systems, currently operating or under development, from a source outside your institution? If yes, please list each such system and indicate the supplier (vendor, other institution, etc.) for these systems, and comment on your experience with the system. Indicate degree of adaptation effort required, efficiency/adequacy/operation, and offer any other evaluative comments as you deem appropriate.

_____

_____

_____

_____

_____

E. For administrative systems listed above as under consideration for development, is your institution considering purchasing these systems from an outside vendor? If yes, please list the systems you are considering purchasing.

_____

_____

_____

_____

_____

STUDENT ACCESS TO COMPUTING RESOURCES -

FOR COMPUTER CENTER DIRECTORS

Institution _____ Date _____

Completed by _____ Title _____

Please answer the following questions with regard to access to computing resources for undergraduate students. Please respond in the context of all students, not just those whose major areas require computing access.

	YES	NO
A. Computer Hardware		
Do your students have access to:		
1. a card reader?	___	___
2. a card reader on campus?	___	___
3. card readers at more than one location on campus?	___	___
4. line printer output?	___	___
5. line printer output on campus?	___	___
6. line printers at more than one location?	___	___
7. line printer with lower case letters?	___	___
8. punched paper tape I/O?	___	___
9. plotter for output?	___	___
11. magnetic tape I/O?	___	___
12. access to batch more than 12 hours a day?	___	___
13. access to batch more than 18 hours a day?	___	___
14. access to batch more than 5 days a week?	___	___
15. 8K or more of available memory for jobs?	___	___
16. 16K or more of memory?	___	___

	YES	NO
10. CRT terminals with graphics?	___	___
11. CRT terminals with a light pen or other positional input?	___	___
12. CRT terminals with cassette or other storage medium?	___	___
13. CRT terminals operating at 1200 baud or faster?	___	___
14. Do you have at least one terminal per 1000 students?	___	___
15. At least one terminal per 500 students?	___	___
16. At least one terminal per 100 students?	___	___
17. At least one terminal per 50 students?	___	___

D. Software and Languages

Do your students have access to:

1. FORTRAN?	___	___
2. COBOL?	___	___
3. RPG?	___	___
4. BASIC?	___	___
5. an enhanced BASIC?	___	___
6. APL?	___	___
7. PL/1?	___	___
8. LISP?	___	___
9. SNOBOL?	___	___
10. WATFIV?	___	___
11. ALGOL?	___	___
12. SPSS?	___	___
13. BMD?	___	___
14. an on-line statistical package?	___	___
15. other statistical packages?	___	___

	YES	NO
17. 32K or more of memory?	___	___
18. 64K or more of memory?	___	___
19. virtual memory system?	___	___
20. computers of more than one manufacturer?	___	___

B. Unit Record Equipment

1. Are keypunches available for students to use without permission?	___	___
2. Are keypunches available for more than 18 hours a day?	___	___
3. Do you have at least one keypunch per 1000 students?	___	___
4. Do you have at least one keypunch per 500 students?	___	___
5. Is there a sorter available for students to use?	___	___
6. Is there an interpreter available for students to use?	___	___
7. Can students buy (or get free) cards within 50 yards of keypunches?	___	___

C. Terminals

Are terminals of the following kinds generally available to students in reasonable numbers?

1. hard copy terminals?	___	___
2. hard copy terminals with the APL character set?	___	___
3. hard copy terminals with cassette or other storage medium?	___	___
4. hard copy terminals operating at 300 baud or faster?	___	___
5. hard copy terminals with upper and lower case letters?	___	___
6. hard copy terminals with quality (typewriter-like) output?	___	___
7. CRT terminals?	___	___
8. CRT terminals with upper and lower case?	___	___
9. CRT terminals with the APL character set?	___	___

	YES	NO
16. a data management system?	___	___
17. a simulation language?	___	___

E. Documentation

1. Is there a relatively complete set of documents (hardware and software) available for reference within convenient distance of the batch input station(s) and terminal areas?	___	___
2. Is documentation of the system and software available for students to borrow for at least a few days at a time?	___	___
3. Are most documents available for sale to students on the campus?	___	___
4. Does the computer service organization produce at least 100 pages of its own documentation for its own users?	___	___
5. Has this documentation been updated within the past 12 months?	___	___
6. Is it accurate and up-to-date?	___	___
7. Does it have an index?	___	___
8. Is there an introduction, of any length, specifically addressed to users with NO prior experience with computers or programming?	___	___
9. Is some documentation of the system available on-line (e.g., HELP files)?	___	___
10. Does the computer center publish a newsletter or information bulletin?	___	___
11. Does it appear at least once a month?	___	___
12. Do more than 25 percent of the copies go to students?	___	___

F. Consultation and Advice

1. Is a consultant available to students in some public area (e.g., not in an office)?	___	___
2. Is the consultant available more than 5 hours per day?	___	___

	YES	NO
3. Is the consultant available more than 5 days per week?	___	___
4. Is the consultant available after 5 p.m.?	___	___
5. Is the consultant available by phone?	___	___
6. Is there a consultant with specific and detailed knowledge of statistics and the available statistics packages?	___	___
7. Can your consultant provide advice to people who want services the center does not provide (e.g., where to get cards punched, where to get statistics help, where to run a LISP program)?	___	___
8. Are orientation or other classes available during the school year?	___	___
9. Are more than 10 hours of such classes offered each year?	___	___
10. Are more than 10 hours of such classes offered between December and June?	___	___
11. Are canned orientations available -- on video tape, cassette, or filmstrip?	___	___

G. Convenience

1. Are student-accessible terminals available at more than one location on campus?	___	___
2. Is the nearest terminal area within a five-minute walk from the library?	___	___
3. Is the nearest terminal area within a five-minute walk from the English Department?	___	___
4. Are terminals (and computing service to support them) available more than 18 hours a day?	___	___
5. Are there any terminals in dormitories?	___	___
6. Is the nearest batch-entry station within a five-minute walk from the library?	___	___
7. Is the nearest batch-entry station within a five-minute walk from the English Department?	___	___
8. Is scheduled maintenance performed during non-prime shift?	___	___

	YES	NO
9. Can a student with a small compile-and-go batch job reasonable expect 15 minute turnaround afternoons during the last week of classes?	___	___
10. Can a student reasonably expect to find an available terminal on campus afternoons during the last week of classes?	___	___

H. Red Tape

1. A student wants to use the computer for work associated with a class but it is not required by the instructor. Can he do this without special permission?	___	___
2. A student has a research project he is interested in; it is not associated with any class he is taking. Can he do this without special permission?	___	___
3. If he requires permission, is it relatively easy to obtain? Is an oral request adequate?	___	___
4. Are the answers to these questions independent of the student's department?	___	___
5. Are they independent of the student's level (i.e., graduate or undergraduate)?	___	___
6. A student wants to write a program for an unknown purpose. Is it relatively easy for him to do this?	___	___
7. Can a student buy time from your center to do things (like STARTREK) that your policies do not allow?	___	___
8. A faculty member in the French Department has received a tape from a colleague with some computer-based instructional materials on it; he has no prior computer experience himself. Can he get help from the computer center or associated office in installing it?	___	___
9. Can he get computer time to try it out without a hassle?	___	___
10. Can he get computer time for his students to use it without a hassle?	___	___

I. Awareness

1. What percentage of the students who leave your campus have used computers for some purpose? (Use best estimate)	____%
2. What percentage of the students who leave your campus can write a simple program? (Use best estimate)	____%

STATE-WIDE COMPUTING OBJECTIVE ASSESSMENT QUESTIONNAIRE

The purpose of this survey is to provide basis for assessing the appropriateness of a list of state-wide computing objectives for Missouri higher education. This list of possible objectives was generated by the MDHE sponsored Computer Policy Task Force, a group of institutional representatives and state administrators. We request that the Chief Executive Officer of each public higher education institution in the state personally fill out this questionnaire in order to provide policy level views of these issues.

Institution_____ Date_____

Completed by_____ Title_____

Instructions: Each possible objective listed on the questionnaire is preceded by one of two scales. The first, "Appropriateness?", appears with each objective statement. It asks for a rating of the appropriateness of this objective for Missouri higher education (1 for extremely inappropriate; 5 for extremely appropriate). The second question, "Being Met?", asks your opinion about the degree to which specific objectives directly applicable to campus computing activities are currently being met at your institution (1 for not at all; 5 for extremely well). The second question is not asked for items about state-wide activities that are not being done at the present time.

We ask that you respond to the objectives as currently written. We would welcome any comments about modification, editing, addition, or deletion of these objectives you may wish to offer on separate sheets.

DRAFT OBJECTIVES ASSESSMENT QUESTIONNAIRE

General (Global) Objectives

1. Missouri higher education institutions should have access to computing facilities, personnel and software capable of meeting needs and objectives identified in the following areas:

ppropriateness?
2 3 4 5 a. academic uses (including instruction and research);

2 3 4 5 b. library uses;

2 3 4 5 c. administrative (including financial and student information control systems);

2 3 4 5 d. public service (including the possibility of providing computing services to schools, other colleges and universities, and local, state and federal government agencies).

---

ppropriateness?
2 3 4 5

2. Higher education in Missouri should attempt to meet current and anticipated computing needs by as effective and efficient means as possible. Effectiveness refers to providing levels of service generally considered desirable and appropriate and efficiency refers to finding the most economical means possible of providing these services. Effectiveness and efficiency should be considered in tandem since the most economical methods of providing services are not always the most appropriate for the users and therefore can, at times, decrease effectiveness. However the relative costs of different hardware, software, and personnel alternatives must be considered when evaluating possible strategies for achieving state-wide objectives. Measures of effectiveness and efficiency should take into account institutional objectives, user needs, hardware costs, software development costs, and personnel requirements.

---

ppropriateness?
2 3 4 5

3. Whenever appropriate the cost of developing computing services, including personnel and other software development costs, should be shared among several institutions. The resource sharing approach can reduce the overall costs of development and maintenance of computing systems and can, where appropriate, provide for greater standardization, or other benefits.

---

ppropriateness?
2 3 4 5

4. State-wide planning for higher education computing in Missouri should take place on a regular and routine basis, probably yearly. This planning process should include on-going cost/benefit analysis of state-wide and institutional policy alternatives.

Specific Objectives

Appropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	1.	Every student in higher education should have the opportunity to acquire computing skills. (This implies more than "computer appreciation" courses which do not include actual computer programming and usage).
Appropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	2.	Students in noncomputer science curricula should have access to the computer if it has become a commonly used tool in their particular field of study. This implies the existence of applications software as well as facilities for original programming.
Appropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	3.	Training should be available to faculty who wish to become familiar with computer applications in their disciplines. Such training could include instruction in computer science (programming), but should not be limited to that, since there are needs to learn computing techniques in the teacher's own discipline--e.g., use of statistical packages and instructionally-oriented data bases in the social sciences.
Appropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	4.	Technical consulting and other academic support services should be available to faculty computer users at all institutions, either locally or through a central support organization.
Appropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	5.	All institutions of higher education should be able to acquire computing capability, not necessarily via an on-campus computer, for both administrative and academic computing.
Appropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	6.	Applications software should be available without the necessity for each institution to develop software "from scratch."
Appropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	7.	Software acquisition should be facilitated through provisions for sharing, with procedures coordinated on a state-wide level, possibly involving a central computer support organization.

ppropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	8.	Administrative computing requirements for public higher education in Missouri, including the needs for on-line data base management, systems development and acquisition, and staff training and retention, shall be studied and where inadequacies exist, solutions will be developed on a cooperative, state-wide basis as appropriate.
ppropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	9.	Campus information systems must accommodate both the needs of the institution for internal management and requirements for reporting to the Department of Higher Education and other state and federal agencies.
ppropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	10.	State institutions for whom community service is a part of their mission should, when computing resources are available and on an appropriate cost reimbursement basis, provide computing services in the instructional and administrative areas for public schools, private higher education, local governments (cities and counties), state agencies, and other not-for-profit enterprises. Public service computing services provided by Missouri institutions should be implemented through a coordinated state-wide planning effort, however, so that excess duplication of computing services and facilities can be avoided.
ppropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	11.	Institutions should use computers to improve their library services and the Department of Higher Education, through the Missouri State Library, should develop a state-wide library computing system that, at a minimum, provides up-to-date catalogue information to library users at public institutions in the state and at private institutions when appropriate cooperative arrangements have been made.
ppropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	12.	Access to specialized out-of-state computing resources, such as EDUNET and/or other national networks, should be available to Missouri higher education institutions.
ppropriateness? 1 2 3 4 5 Being Met? 1 2 3 4 5	13.	Training opportunities should be available for faculty who wish to become familiar with CAI languages, course materials, and programs that are applicable to their discipline.
ppropriateness? 1 2 3 4 5	14.	A facilitating mechanism or network should be developed in Missouri which gives each institution in the state access to specialized computing resources which might be available at other institutions. Independent institutions should be allowed access to the network on a cost reimbursement basis.

Appropriateness?
1 2 3 4 5

15. A CAI center should be implemented in Missouri which provides access to existing instructional programs for public institutions in the state. Access to CAI programs should be made available to public schools as well as to higher education institutions.

Appropriateness?
1 2 3 4 5

16. Computer support for faculty and student research should be provided as needed by these educational activities. As part of the continuing state-wide planning, a special committee should examine the needs in this area, identify existing deficiencies, and make recommendations that can be addressed on a state-wide basis.

Appropriateness?
1 2 3 4 5

17. A state-wide organization should be created in Missouri which facilitates sharing of computer resources (including hardware and software), coordinates state-wide consulting services for computing, facilitates the development of instructional and other academic computing, and serves as a clearinghouse for information about available computer resources. Such an organization would not necessarily have a hardware network component, but it would keep an up-to-date inventory of computer hardware in public higher education institutions, including information on equipment that might be available for redistribution.

ACADEMIC COMPUTING SURVEY FOR

CHIEF ACADEMIC ADMINISTRATOR

Institution _____ Date _____

Completed by _____ Title _____

Instructions: For items 1 through 3 use best estimate of percentages. For items 4 through 9 please feel free to provide comments on additional sheets as necessary.

1. In your opinion, what percentage of your students should have computing skills at each of these levels in order to be able to perform successfully as students and after they receive their degrees? What percentage currently have such skills?

	Should	Currently
No capability	_____%	_____%
General awareness (a course about computers and computing but little or no direct use of the computer required)	_____%	_____%
Indirect use (use package programs and instructional materials on the computer but without programming or training about computers)	_____%	_____%
Elementary programming (one course in programming or equivalent instruction)	_____%	_____%
Intermediate programming (two courses in computer science or equivalent)	_____%	_____%
Advanced programming (three or more courses in computer science)	_____%	_____%
TOTAL	100%	100%

2. In your opinion, what percentage of your students should have access to computing at each of these levels in order to perform their class and homework assignments? What percentage currently have such access?

	Should	Currently
No computer use for course work	____%	____%
Occasional access to computers for problems associated with some classes (one or two classes per week)	____%	____%
Frequent access to computers for solving problems associated with some classes (three to five classes per year)	____%	____%
Continuous access to computers for solving problems associated with most classes (more than five classes per year)	____%	____%
TOTAL	100%	100%

3. In your opinion, what percentage of your students should make use of computing for their independent research work at each of these levels? What percentage currently make such use of computing?

	Should	Currently
No computer use for research	____%	____%
Computer-based information a minor factor in research (less than 2 weeks of computer-related work)	____%	____%
Computer-based information a considerable factor in research (2 to 8 weeks of computer-related work)	____%	____%
Computer-based information a major factor in research (more than 8 weeks of computer-related work)	____%	____%
Computer-based information the central part of the research (20 weeks or more of computer-related work)	____%	____%
TOTAL	100%	100%

4. What use do your faculty make of computing in their research? Do you have any measures (e.g., expenditures, CPU time, man-hours of staff) of research utilization of computing (actual or estimated)? What percentage of your faculty make use of computing in support of research? To what extent is this utilization restricted by your current campus facilities/resources for data processing?

5. If additional resources were made available what would be the optimal level of research computing at your institution? What percentage of the faculty would be involved? What sorts of additional resources would be needed? (Time-sharing? Large job batch? Other?)

6. What use do your faculty make of instructional computing resources; do you have any measures of instructional utilization of data processing (actual or estimated)? What percentage of your faculty utilize computing to supplement their course offerings (or what percentage of your course offerings are supplemented by computing)?

7. Does the level and extent of instructional computing need to be increased at your institution? What factors are limiting current applications? What sorts and levels of resources need to be made available?

8. Does your current instructional computing offering meet the needs of industry for computer science graduates? Are you able to satisfy the needs for computer science training of non-computer science graduates? To what level of proficiency would you aspire for your non-computer science graduates?

9. What sort of additional resources would be necessary to bring your graduates (both computer science and non-computer science) to an acceptable proficiency level in computing?

10. Please indicate if the faculty in the following discipline areas make use of computing in instruction or research. Indicate with check (✓) if answer is yes.

HEGIS Discipline Division	No Classes Using Computing	Classes Using Problem-Solving	Classes Using CAI	Classes Using CMI	Faculty Research Using Computing	Other Specify
Agric. & Nat. Resources						
Architect. & Environ. Design						
Area Studies						
Biological Studies						
Business & Management						
Communications						
Computer & Inform. Sciences						
Education						
Engineering						
Fine & Applied Arts						
Foreign Languages						
Health Professions						
Home Economics						
Law						
Letters						
Literary Science						
Mathematics						
Military Science						
Physical Sciences						
Psychology						
Public Affairs & Service						
Social Sciences						
Theology						
Interdiscliplinary Studies						
Business & Commerce Tech.						
Data Processing Tech.						
Health Serv. & Planned Tech.						
Mech. & Engineering Tech.						
Natural Science Tech.						
Public Serv. Related Tech.						

Appendix G

COMPUTING IN MISSOURI HIGHER EDUCATION
INSTITUTIONAL PROFILES

The attached profiles provide a brief summary of the status of computing at state-supported higher education institutions in Missouri. Responses to three questionnaires were used to compile the profiles:

1) Update of Inventory of Computers for Missouri Higher Education (completed by Computer Center Directors);

2) Management Systems Development Survey (completed by Chief Administrators for Data Processing); and

3) Academic Computing Survey for Chief Academic Administrator.

UNIVERSITY OF MISSOURI, CENTRAL ADMINISTRATION

Computer Inventory (University of Missouri Computer Network)

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	AMD	470/V7	8,000	16,040
1	IBM	370/158	3,000	

Expenditures

1977-78--$5,746,000

Administrative Computing

University of Missouri Central Administration maintains computerized information systems in Planning, Management & Institutional Research, Financial Management, General Administrative Services, Auxiliary Services, and Logistics & Related Services. In each area, computerized systems are currently in production. Processing is either batch or combined batch and on-line. Several systems in the Financial Management Applications and General Administrative Service Application areas are currently being modified and updated.

UNIVERSITY OF MISSOURI, COLUMBIA

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
(Campus Computing Center)				
0	AMD	470/V7		
0	IBM	370/58		
2	IBM	360/20		
1	IBM	360/22		
1	DEC	PDP1120		
3	DEC	PDP8		
15	DEC	PDP1103		
1	DEC	PDP1105		
(ADP Production)				
0	AMD	470/V7		
0	IBM	370/158		
1	IBM	3790	192	25
1	IBM	SYS-32	16	14
(Medical Computer Center)				
0	AMD	470/V7		
0	IBM	370/158		
1	IBM	53/150	512	500
1	IBM	Series 1		
1	IBM	3777	16	0
1	Phase	1V40	72	3
(Radiology)				
1	DEC	PDP15	264	90
1	DEC	PDP1576	96	60
(Information Science)				
1	DEC	PDP11/34	4	

Expenditures

(Campus Computing Center)
1977-78--$701,000
1978-79--$806,000

(ADP Production)
1977-78--$74,000
1978-79--$128,000 (projected)

(Medical Computer Center)
1977-78--$2,341,000
1978-79--$2,115,000 (projected)

(Information Science)
1977-78--$41,846

UNIVERSITY OF MISSOURI, COLUMBIA (CONTINUED)

Academic Computing

Computing is used by faculty for instruction and research in most disciplines. The only HEGIS discipline categories in which computing is not part of the instructional program are Foreign Languages, Letters, Literary Science, and Military Science. In most instances, courses use computers for problem solving. CAI is used in Engineering and Physical Sciences, and CMI is used in Engineering. Computer Aid Testing is also used in some areas.

Administrative Computing

Computerization of administrative systems was considered relevant to UMC for all systems except a few systems in the Logistics & Related Services area. (Hospital Applications were not reported.) In each area, computer systems are in production. A few new systems in the Planning, Management, & Institutional Research area (Student Flow Modeling, Resource Requirements, Modeling, Induced Course Load Matrix Analysis, Support Staff Analysis, and Faculty Activity Analysis) are under development. Some of the systems in other areas are under modification. Processing is either batch or combined batch and on-line.

UNIVERSITY OF MISSOURI, KANSAS CITY

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
0	AMD	470/V7		
0	IBM	370/158		

Expenditures

1977-78--$373,000
1978-79--$415,000 (projected)

Academic Computing

UMKC reported moderate use of computing in instruction and research. Courses in Business & Management, Education, Engineering, Health Professions, and Physical Sciences make use of computers. CAI and CMI are used in the Health Professions and problem solving is used in the other areas.

Administrative Computing

Automated information systems are both developed and under development at UMKC. Systems are in production in the Planning, Management & Research and Admissions & Records Applications areas. Most operating systems use batch processing. Financial Management Applications and General Administration Service Applications used combined manual and computer information systems. Automation of systems in Auxiliary Service Application, Physical Plant Operations and Financial Aid Administration is being considered. In the Library Applications area, automated systems are in production as on-line systems or are being developed. Hospital Applications are half manual, and half computerized, operating in all three modes.

UNIVERSITY OF MISSOURI, ROLLA

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
(UMR Computer Center)				
1	IBM	360/50	524	146
7	DAG	NOVA800	32	40
1	DAG	ECLIPSE	96	10
1	DAG	NOVA840	48	10
2	DAG	NOVAZ	16	
0	AMD	470/V7		
0	IBM	370/158		
(Computer Science Department)				
1	MID	1621	16	5
1	HON	516	16	
1	IMS	8080	12	
1	TECHHNICO		4	
1	PET		8	

Expenditures

(Computer Center)
1976-77--$417,000
1977-78--$419,000 (estimated)

(Computer Science)
1976-77--$19,000
1977-78--$7,000
1978-79--$25,000 (projected)

Academic Computing

Faculty make extensive use of computing in instruction and research. Courses in most HEGIS disciplines categories make use of computing for problem solving. In addition, Computer Science uses CMI and CAI, and Engineering and Mathemathics use CAI.

Administrative Computing

UMR has a well developed management information system. Computer systems are in production in every area except Financial Aid, where computerization is under consideration. Most systems use batch processing. Library systems are on-line.

UNIVERSITY OF MISSOURI, ST. LOUIS

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
0	AMD	470/V7		
0	IBM	370/158		
1	GAM	SPC/6	64	2.5
1	DEC	PDP8E	32	.25
1	PRO	TECH	32	.25
1	KRO	72	32	.25
1	IBM	370/125	256	280

Expenditures

1976-77--$421,000
1977-78--$400,000 (projected)

Academic Computing

UMSL faculty make little use of computing in instruction and moderate use of computing in research. Business & Management was the only HEGIS discipline that reported use of computing in instruction; problem solving is used.

Administrative Computing

UMSL management information systems are moderately well developed. Some systems are in operation in each area; the most developed systems are in the Admissions & Records Applications area. Computerized systems are either batch or, in a few instances, combined batch and on-line.

CENTRAL MISSOURI STATE UNIVERSITY

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	370/148	1,000	980

Expenditures

1977-78--$732,000
1978-79--$791,000 (projected)

Academic Computing

Faculty at Central make moderate use of computing in both instruction and research. Problem solving was reported for courses in approximately half of the HEGIS discipline categories. CAI and CMI are being experimented with in Psychology and CAI is used in Business & Management.

Administrative Computing

Central has a moderately well developed computerized information system. Some systems in each administrative area are in production. Admissions & Records Application has the largest number of systems in operation; most are on-line. Combined manual and computerized systems are used in most other areas. Several systems in the Planning, Management & Institutional Research, Logistics & Related Services, Physical Plant Operations, and Library Applications areas are under consideration for development.

HARRIS-STOWE COLLEGE

Computer Inventory

No computer reported

Academic Computing

Very little academic computing was reported. Classes using computing for problem solving were reported in Mathematics only.

Administrative Computing

All information systems at Harris-Stowe are manual. No computer development was reported.

LINCOLN UNIVERSITY

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	Data100	74	64	5
0	IBM	370/158		
0	AMD	470/V7		

Expenditures

1976-77--$184,000
1977-78--$215,000 (estimated)

Academic Computing

Faculty make light use of computing in instruction and research. Courses using computing for problem solving were reported in seven HEGIS disciplines; faculty research use was reported in four disciplines.

Administrative Computing

Administrative systems are in the initial stages of development at Lincoln, although computerization is considered relevant for most areas. Admissions & Records was the only area with operational systems. Systems in the Financial Aid Administration, Physical Plant, Logistics & Related Services, and Administrative Services area are under consideration for development. Some systems in the Planning, Management & Research and Financial Management areas are currently under development. All automated systems are currently using batch processing.

MISSOURI SOUTHERN STATE COLLEGE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	370/115	190	210
2	IBM	1130	8	2

Expenditures

1976-77--$269,000
1977-78--$275,000 (projected)

Academic Computing

Southern reported light to moderate faculty use of computing for instruction and research. Seven HEGIS disciplines reported using computing for problem solving in courses. Faculty in five disciplines categories use computing for research.

Administrative Computing

Southern has a moderately well developed computerized information system. Systems in Planning, Management & Research, Financial Management, and Admissions & Records are in production. All operating systems use batch processing. No new systems were reported as under consideration for development or as under development or modification.

MISSOURI WESTERN STATE COLLEGE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	360/30	256	84

Expenditures

1977-78--$223,854
1978-79--$238,714 (projected)

Academic Computing

No response to questionnaire.

Administrative Computing

Western is in the process of developing a computerized information system. Computerization is considered relevant for many systems that are operated manually. In most areas--Financial Management, General Administrative Services, Logistics & Related Services, Financial Aid, and other Administrative Applications--systems are currently under consideration for development. Some systems are either in production or operating with a combined manual and computerized system in the Planning, Management & Research and Admissions & Records areas.

NORTHEAST MISSOURI STATE UNIVERSITY

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	BUR	3500	240	214
1	BUR	751	16	
1	HON	1640	64	30
1	IBM	5100	32	

Expenditures

1976-77--$308,000

Academic Computing

Faculty at Northeast make moderate use of computing in instruction and research. Courses in thirteen HEGIS discipline groups use computing, compared to six in which no classes using computing were reported. Problem solving and CMI were used in most of these discipline areas, while CAI was used in four areas (Business & Management, Computer & Information Sciences, Education, and Mathematics). Faculty research using computing was reported in twelve discipline categories.

Administrative Computing

Northeast has a moderately well developed computerized information system. Most systems in the Financial Management and Admissions & Records areas are in operation; all three processing modes--batch, on-line, and combined--are in use. All other areas use both manual and combined manual-computerized systems. Some systems in the Planning, Management & Research and other Administrative Systems areas are under consideration for development.

NORTHWEST MISSOURI STATE UNIVERSITY

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
0	AMD	470/V7		
0	IBM	370/158		
1	DEC	1170	512	352
1	IBM	360/30*	64	56

* to be removed July 1, 1979

Expenditures

1976-77--$194,000
1977-78--$290,000 (estimated)

Academic Computing

Faculty in most HEGIS discipline areas make use of computing in instruction and research. Courses in seventeen areas use computing. Courses in most disciplines use problem solving, although courses in seven use CAI and courses in three use CMI. Faculty in eleven disciplines use the computing for research.

Administrative Computing

Administrative computing at Northwest is moderately well developed. There is a mixture of manual, combined-manual-and-computerized, and computerized systems. Planning, Management & Research systems are either entirely manual or combined manual and computerized with batch processing. Most Financial Management systems are in production with on-line or batch processing. Most Admissions & Records systems are in production and use batch processing. Each of the other areas has a mixture of manual systems and computerized systems that are in production. Computerization was relevant for systems in all areas.

SOUTHEAST MISSOURI STATE UNIVERSITY

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	360/40	256	87
1	IBM	370/135	244	367

Expenditures

1976-77--$498,000
1977-78--$575,000 (estimated)

Academic Computing

Academic computing questionnaire was not returned.

Administrative Computing

Southeast has already computerized many of its administrative systems, and is currently in the process of either modifying existing systems or considering the development of new systems. Computerization is considered relevant in all areas except Health Science. Financial Management and Admissions & Records currently have most systems in production, using primarily batch processing in the latter and combined batch and on-line systems in the former. Most systems in other areas are manual or combined computerized and manual.

SOUTHWEST MISSOURI STATE UNIVERSITY

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	370/138	512	700

Expenditures

1977-78--$494,000
1979-80--$500,000 (projected)

Academic Computing

Faculty in slightly over half of the HEGIS disciplines use computing for instruction and research. Problem solving was used in each course area reporting the use of computing in courses.

Administrative Computing

Southwest has a moderately well developed computerized information system. Computerization of most systems was considered relevant except for Physical Plant Operations. Most of the systems in the Admissions & Records area are in production. The other areas have a mixture of manual, combined-manual-and-computerized, and operating systems. At present systems are being developed or modified in Financial Management, General Administrative Services, and Auxiliary Services.

CROWDER COLLEGE

Computer Inventory

No computer facility.

Expenditures

1977-78--$3,000 (contracted)

Academic Computing

Faculty at Crowder make almost no use of computing. A course in mathematics using problem solving was the only instructional computing reported.

Administrative Computing

Computerization in Planning, Management & Research (in budget preparation, analysis and control and HEGIS and DHE reporting) were the only systems where computerization was considered relevant to the institution. These are contracted with a local CPA.

EAST CENTRAL COLLEGE

Computer Inventory

No computer facilities.

Expenditures

None reported.

Academic Computing

No academic computing reported.

Administrative Computing

None reported. Not considered relevant to institution.

JEFFERSON COLLEGE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	NCR	101	32	20

Expenditures

1977-78--$54,000
1978-79--$43,000 (projected)

Academic Computing

Jefferson College makes minor use of computing in instructions. Engineering uses computing for problem solving in courses. Courses in Business & Management, Computer & Information Sciences, and Business & Commerce Technologies also make some use of computing in instructional programs.

Administrative Computing

Jefferson College has some computerization of administrative systems; usually combined with manual systems and utilizing batch processing. Areas in which at least one system is computerized include: Planning, Management & Research, Financial Management, Auxiliary Services, Logistics & Related Services, Physical Plant Operations, Admissions & Records, and Financial Aid. New systems are under consideration for development in the Financial Aid and Financial Management areas. A system is currently under development (Degree Requirement Evaluation) in the Admissions & Records area.

METROPOLITAN COMMUNITY COLLEGE SYSTEM

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	370/135	384	560
3	IBM	3277		

Expenditures

1977-78--$547,000

Administrative Computing

Metropolitan central offices maintains automated systems for the entire system. Initial computerization has taken place in Planning, Management & Research, Financial Management, Administrative Services, Auxiliary Services, Logistics & Related Services, Admissions & Records, and Financial Aid. Systems are under consideration for development in Financial Management and Financial Aid. Manual systems are also utilized in each area. Most systems use batch processing, except Financial Aid and Admissions processing, which are on-line.

PENN VALLEY COMMUNITY COLLEGE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	3780		
6	IBM	3277		
3	IBM	3277		
1	IBM	5100		
6	PET	2001		
2	051	3		

Expenditures

1977-78--$18,000

Academic Computing

Faculty at Penn Valley make moderate use of computing in instruction. Courses using computing were reported in ten HEGIS discipline areas. Problem solving and CAI are used exclusively in two disciplines each. The remainder use some combination of problem solving, CAI, and CMI. Faculty use of computers for research was reported in two discipline areas, Computer and Information Sciences and Data Processing Technology.

Administrative Computing

Maintained by Metropolitan System Office.

LONGVIEW COMMUNITY COLLEGE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
3	IBM	3277		
4	IBM	3277		
1	IBM	3780		
1	DEC	PDP8A	16	1.5
1	DEC	PDP11V03	64	1
1	HEATH KIT	H11	20	
1	RADIO SHACK	TRS80	16	
1	SW	6800	32	

Expenditures

1977-78--$68,000

Academic Computing

Courses using problem solving were reported in five HEGIS discipline areas.

Administrative Computing

Maintained by Metropolitan System Office.

MAPLE WOODS COMMUNITY COLLEGE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
3	IBM	3277		
1	IBM	3277		
1	IBM	3780		

Expenditures

1977-78--$10,000

Academic Computing

Courses using computing for problem solving were reported for six HEGIS discipline areas.

Administrative Computing

Maintained by Metropolitan System Office.

PIONEER COMMUNITY COLLEGE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
2	IBM	3277		

Expenditures

None reported.

Academic Computing

Courses using problem solving reported in Computer & Information Sciences.

Administrative Computing

Maintained by Metropolitan System Office.

MINERAL AREA COLLEGE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	WANG	600		
5	PET	2001		

Expenditures

1977-78--$9,000

Academic Computing

Courses using problem solving were reported in six HEGIS discipline areas.

Administrative Computing

Although computerization was considered relevant for systems in all but one administrative area, all administrative systems are currently operating manually or not at all. No systems are currently under consideration for development.

MOBERLY JUNIOR COLLEGE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	1130	8	5

Expenditures

1977-78--$13,000

Academic Computing

Use of computers in instruction was reported in three HEGIS disciplines. Computer & Information Sciences uses CAI, Mathematics uses problem solving, and Data Processing uses both problem solving and CAI.

Administrative Computing

Moberly makes limited use of administrative computing. Combined manual and computerized systems are used in Planning, Management & Research, Financial Managment and Admissions and Admissions & Records. All systems use batch process. Computerization is considered relevant for more than one system in every area except physical plant.

ST. LOUIS COMMUNITY COLLEGE CENTRAL OFFICE

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	370/135	512	1,200

Expenditures

1977-78--$585,000
1978-79--$585,000

Administrative Computing

Computerization of systems in each area was considered relevant to the institution. Most administrative systems combine manual and computer processing. Admissions & Records, the most highly computerized area, has in-production systems that are being rewritten and updated. Each of the other administrative areas has a mixture of manual systems, combined manual-and-computerized systems, and fully computerized. Batch or combined batch and on-line processing is used for all systems in areas other than Admissions & Records, which has some on-line systems.

ST. LOUIS COMMUNITY COLLEGE, FLORISSANT VALLEY

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
(Not reported)			128	45

Expenditures

1976-77--$103,000

Academic Computing

Questionnaire not completed.

Administrative Computing

Maintained by Central Administration.

ST. LOUIS COMMUNITY COLLEGE, FOREST PARK

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	HEP	2000AC	128	30
0	IBM	370/135		

Expenditures

1977-78--$61,000

Academic Computing

Faculty in twelve HEGIS discipline areas at Forest Park utilize computing in instruction. Faculty research was reported in five discipline areas. Courses use a mixture of computer instruction modes; problem solving, CAI, and CMI are all used in several of the discipline areas using computing in instruction.

Administrative Computing

Maintained by Central Administration.

ST. LOUIS COMMUNITY COLLEGE, MERAMEC

Computer Inventory

Qty.	Mfg.	Model	Core(K)	Disc(M)
1	IBM	1/30	16	1
0	IBM	370/155		
0	IBM	370/135		
0	HEP	2000AC		

Expenditures

1977-78--$103,000

Academic Computing

Faculty in seven HEGIS discipline areas were reported to use computing in their courses. Problem solving was used in each instance.

Administrative Computing

Maintained by Central Administration.

STATE FAIR COMMUNITY COLLEGE

Computer Inventory

No computers reported.

Expenditures

None reported.

Academic Computing

None reported.

Administrative Computing

Some administrative computing contracted with local firm.

THREE RIVERS COMMUNITY COLLEGE

Computer Inventory

No machine-contracted service.

Expenditures

1976-77--$11,000

Academic Computing

Faculty at Three Rivers do not make use of computing in their instructional or research programs.

Administrative Computing

Three Rivers Community College makes only limited use of administrative computing, although computerization of some systems in most administrative areas was considered relevant to the institution. One or more combined-manual-and-computerized systems are used in Financial Management, Admissions & Records, and Financial Aid.

TRENTON JUNIOR COLLEGE

Computer Inventory

No computer hardware is available at Trenton.

Academic Computing

No use of computing in instruction.

Administrative Computing

All administrative data processing systems are either manual or not in existance. Computerization was considered relevant for some systems in each of the administrative areas.

Appendix H

OBJECTIVES ASSESSMENT QUESTIONNAIRE RESULTS

As part of the study of higher education computing in Missouri, a questionnaire was used to assess the appropriateness of a list of general and specific objectives being considered by the Computer Policy Task Force. The questionnaire was completed by the chief executive from the institution or, in a few instances, by an individual designated by the chief administrator. The instrument was designed to assess presidents' and chancellors' attitudes about the appropriateness of possible state-wide objectives which were being considered by the Computer Policy Task Force. In addition, in those instances when objective statements were directly applicable to campus activities, they were asked their opinions about the degree to which these objectives were currently being met at their institutions.

The following analysis presents the results of this questionnaire. It is presented as a context for determining the appropriateness of general and specific objectives. This analysis presents each objective statement, then discusses the distribution of responses. Five-point scales were used to rate the appropriateness and the degree to which objectives were currently being met: with 5 extremely appropriate, 4 was appropriate, 3 was neutral, 2 as inappropriate and 1 as extremely inappropriate.

General Objectives

1. *Missouri higher education institutions should have access to computing facilities, personnel and software capable of meeting needs and objectives identified in the following areas:*

   a. *academic uses (including instruction and research);*

   b. *library uses;*

c. *administrative (including financial and student information control systems);*

d. *public service (including the possibility of providing computing services to schools, other colleges and universities, and local, state and federal government agencies).*

The appropriateness of each of the four specific items was rated individually. Eighty-four percent of all respondents rated academic uses as extremely appropriate. Chief executives from all of the University of Missouri campuses and system and from the other four-year institutions rated this objective as extremely appropriate. All but one of the presidents of the two-year institutions, 91%, rated it as appropriate or extremely appropriate. One individual rated it as neutral.

Library uses was rated as appropriate or extremely appropriate by 84% of all respondents. All of the University of Missouri administrators rated it as extremely appropriate. Eighty-nine percent of the respondents from other four-year institutions rated this statement as appropriate or extremely appropriate. However, twenty-seven percent of the presidents from two-year institutions considered it neutral (18%) or inappropriate (9%). However, most of the presidents of two-year institutions (73%) considered library uses of computing as appropriate or extremely appropriate.

Administrative uses of computing was considered appropriate or extremely appropriate by 92% of the presidents. One president from a two-year institution rated it as neutral.

Public service uses of computing was rated as neutral by 44% of the chief executives. Two respondents from the UM (40%), three from the other four-year (33%), and six from the two-year institutions (55%) considered it as appropriate or extremely appropriate. One president at a four-year institution and two at two-year institutions considered it inappropriate or extremely inappropriate.

2. *Higher education in Missouri should attempt to meet current and anticipated computing needs by as effective and efficient means as possible. Effectiveness refers to providing levels of service generally considered desirable and appropriate and efficiency refers to finding the most economical means possible of providing these services. Effectiveness and efficiency should be considered in tandem since the most economical methods of providing services are not always the most appropriate for the users and therefore can, at times, decrease effectiveness. However, the relative costs of different hardware, software, and personnel alternatives must be considered when evaluating possible strategies for achieving statewide objectives. Measures of effectiveness and efficiency should take into account institutional objectives, user needs, hardware costs, software development costs, and personnel requirements.*

This objective was considered appropriate or extremely appropriate by 96% of all respondents. All of the University of Missouri respondents considered it as extremely appropriate. Three-quarters (75%) of the four-year presidents considered it appropriate and the remainder considered it extremely appropriate. One two-year president considered it as neutral, while the remainder rated it as appropriate or extremely appropriate.

3. *Whenever appropriate the cost of developing computing services, including personnel and other software development costs, should be shared among several institutions. The resource sharing approach can reduce the overall costs of development and maintenance of computing systems and can, where appropriate, provide for greater standardization, or other benefits.*

This objective was rated as appropriate by 74% of all respondents. Twenty-one percent considered it neutral. One president from a four-year institution considered it extremely inappropriate (4% of the total). Two four-year presidents, two two-year presidents, and one University of Missouri respondent rated it as neutral.

4. *State-wide planning for higher education computing in Missouri should take place on a regular and routine basis, probably yearly. This planning process should include on-going cost/benefit analysis of state-wide and institutional policy alternatives.*

Slightly over half (54%) of the respondents consider general objective 4 as appropriate or extremely appropriate. One-quarter considered it neutral (25%), and the remainder (21%) considered it as inappropriate or extremely inappropriate. Sixty percent of the University of Missouri respondents considered this objective as inappropriate or extremely inappropriate. The remainder (40%) considered it appropriate or extremely appropriate. For the other four-year institutions, one-quarter (25%) considered it as inappropriate or extremely inappropriate while 63% considered it extremely appropriate or appropriate. For the two-year institutions 45% rated this objective neutral, and the remainder rated it as appropriate or extremely appropriate.

Specific Objectives

Specific objectives were rated both for appropriateness and for how well they are currently being met, except for those that were not directly applicable to institutional activities.

1. *Every student in higher education should have the opportunity to acquire computing skills. (This implies more than "computer appreciation" courses which do not include actual computer programming and usage).*

Two-thirds (67%) of the respondents rated this objective appropriate or extremely appropriate. University of Missouri respondents rated this objective either as extremely appropriate (50%) or extremely inappropriate (50%) (there were only 4 University of Missouri responses to this item). Two-thirds (67%) of the four-year presidents and three-fourths (74%) of the two-year presidents rated this objective as appropriate or extremely appropriate.

One-quarter (24%) of all respondents felt their institution was meeting this objective either well or extremely well. All University of Missouri respondents (100%) thought it was being met well or extremely well. In contrast, slightly over half (54%) of the four-year presidents and eighty percent of the two-year presidents said this objective was not currently being met well or at all. One four-year president and one two-year president indicated this objective was currently being met.

2. *Students in noncomputer science curricula should have access to the computer if it has become a commonly used tool in their particular field of study. This implies the existence of applications software as well as facilities for original programming.*

Eighty percent of the respondents rated this objective as appropriate or extremely appropriate. Two (40%) of the University of Missouri respondents, one four-year president (11%) and two of the two-year presidents (18%) rated it as neutral. The remainder considered it appropriate.

Over half of the respondents indicated this objective was not being met (53%). One University of Missouri chancellor (20%), four four-year presidents (44%), and eleven two-year presidents (93%) indicated this objective was not being met well or at all. Sixty percent of the UM respondents, 22% of the four-year administrators and none of the two-year administrators said this objective was currently being met well or extremely well.

3. *Training should be available to faculty who wish to become familiar with computer applications in their disciplines. Such training could include instruction in computer science (programming), but should not be limited to that, since there are needs to learn computing techniques in the teacher's own discipline--e.g., use of statistical packages and instructionally-oriented data bases in the social sciences.*

Eighty-eight percent of all respondents considered this objective appropriate or extremely appropriate. The remainder (12%) rated it as neutral. One four-year president (11%) and two two-year presidents (18%) rated it as neutral.

All UM respondents said this objective is currently being met (40%) or that it is being met extremely well (60%). In contrast, one-third of the four-year presidents (33%) and over two-thirds of the two-year presidents (72%) indicated this objective was not being met well or at all. Two-thirds (66%) of the four-year presidents indicated it was being met (44%) or being met well (22%). One-third (33%) of the two-year presidents indicated it was being met.

4. *Technical consulting and other academic support services should be available to faculty computer users at all institutions, either locally or through a central support organization.*

Three-quarters (75%) of the respondents rated this objective as appropriate or extremely appropriate. All of the UM respondents, three-quarters of the four-year respondents (75%), and almost two-thirds (64%) of the two-year respondents rated this objective as appropriate or extremely appropriate. The remainder rated this objective as neutral or inappropriate.

Only 22% felt this objective was currently being met well or extremely well at their institution. All of the UM respondents indicated it was being met well or extremely well. Only half (50%) of the four-year respondents indicated it was being met or being met well - none indicated it was being met extremely well. In contrast, eighty percent of the two-year presidents and fifty percent of the four-year presidents indicated it was not being met well or at all.

5. *All institutions of higher education should be able to acquire computing capability, not necessarily via an on-campus computer, for both administrative and academic computing.*

This was rated as appropriate or extremely appropriate by 88% of all respondents. One UM respondent considered it extremely inappropriate and two-year presidents considered it inappropriate.

Thirty percent indicated it is being met well or extremely well. All UM respondents (only two responded) indicated it was being met extremely well or well. In contrast, only 37% of the four-year presidents and 10% of the two-year presidents indicated it was currently being met well or extremely well. Half of the four-year presidents (50%) and almost half of the two-year presidents (40%) indicated the objective was being met. However, five of the two-year presidents (50%) and one (12%) of the four-year presidents indicated it was not being met well or not at all.

6. *Applications software should be available without the necessity for each institution to develop software "from scratch."*

Most respondents (92%) considered this objective appropriate or extremely appropriate. There were only two exceptions: one four-year respondent rated this objective as extremely inappropriate and one two-year president rated it as inappropriate.

All UM respondents indicated this objective was being met well or extremely well, while one-half of the presidents from two-year (64%) and four-year (63%) institutions indicated this objective was currently not being met well or at all. Only one four-year president and no two-year presidents said it was being met well or extremely well.

7. *Software acquisition should be facilitated through provisions for sharing, with procedures coordinated on a state-wide level, possibly involving a central computer support organization.*

Less than half of the respondents (40%) considered this objective to be appropriate or extremely appropriate. Thirty-two percent rated it as neutral and the remainder (28%) considered it inappropriate or extremely inappropriate. However, over half (55%) of the two-year presidents considered it appropriate or extremely appropriate, while most of the

UM (60%) and four-year (56%) executives considered it inappropriate or extremely inappropriate. Most (76% of the total) felt it was not being met well or at all.

8. *Administrative computing requirements for public higher education in Missouri, including the needs for on-line data base management, systems development and acquisition, and staff training and retention, shall be studied and where inadequacies exist, solutions will be developed on a cooperative, state-wide basis as appropriate.*

Two-thirds of the respondents (67%) rated this objective as appropriate or extremely appropriate. A higher portion of the two-year presidents (82%) than four-year (56%) or UM (50%) executives rated this objective as appropriate or extremely appropriate. One-quarter of all respondents (25%) considered this objective extremely inappropriate.

Most executives (83%) indicated this objective was not being met well or at all. Only one respondent, from UM, indicated it was being met well.

9. *Campus information systems must accommodate both the needs of the institution for internal management and requirements for reporting to the Department of Higher Education and other state and federal agencies.*

Most presidents (88%) rated this objective as inappropriate or extremely inappropriate. Only one, from the University, indicated it was not appropriate. Two others -- a two-year president and a four-year president -- rated it as neutral.

The objective is being met better at the University of Missouri where all those responding (3 out of 5) indicated it was being met well or extremely well. Four of the two-year presidents (36%) indicated it was not being met at all at their institution. Most of the two-year and four-year presidents indicated it was being met or being met well.

10. *State institutions for whom community service is a part of their mission should, when computing resources are available and on an appropriate cost reimbursement basis, provide computing services in the instructional and administrative areas for public schools, private higher education, local governments (cities and counties), state agencies, and other not-for-profit enterprises. Public service computing services provided by Missouri institutions should be implemented through a coordinated state-wide planning effort, however, so that excess duplication of computing services and facilities can be avoided.*

Slightly less than half (48%) of the top executives rated this objective as appropriate or extremely appropriate. Approximately one-quarter (26%) rated it as neutral and approximately one-quarter (26%) rated it as inappropriate or extremely inappropriate. There was a wide variation in the responses for each group.

Over half (60%) indicated it was not being met well or at all. Only two top executives, one two-year president and one four-year president, indicated this objective was currently being met well or extremely well at their institution.

11. *Institutions should use computers to improve their library services and the Department of Higher Education, through the Missouri State Library, should develop a state-wide library computing system that, at a minimum, provides up-to-date catalogue information to library users at public institutions in the state and at private institutions when appropriate cooperative arrangements have been made.*

Most of the top executives (64%) rated this objective as appropriate or extremely appropriate, while only 16% indicated it was inappropriate or extremely inappropriate. However, less than half of the four-year administrators (44%) gave this a high rating.

This objective is not currently being met well at most institutions; 68% indicated it was not being met well or at all. Half of the University of Missouri administrators (50%), 27% of the two-year administrators, and none of the four-year administrators indicated it was being met well or extremely well.

12. *Access to specialized out-of-state computing resources, such as EDUNET and/or other national networks, should be available to Missouri higher education institutions.*

This objective was considered appropriate or extremely appropriate by over half (56%) of the top administrators. Another quarter (24%) rated this as neutral and the remainder (20%) considered it inappropriate or extremely inappropriate. Only five administrators considered it inappropriate or extremely inappropriate, two at four-year institutions and three at two-year institutions.

Most of the executives (87%) indicated this objective was not being met well or at all. Two of the UM and one of the four-year administrators indicated it was being met or being met well.

13. *Training opportunities should be available for faculty who wish to become familiar with CAI languages, course materials, and programs that are applicable to their discipline.*

This objective was rated as extremely appropriate by 80% of the top executives, 20% rated it as appropriate and 20% rated it as neutral. The distribution of responses was similar for each segment.

The objective is being met only at the University of Missouri, where 75% rated it as being met, being met well or being met extremely well. The majority of respondents (58% of the total), including 56% of the four-year administrators and 95% of the two-year administrators indicated it was not being met well or at all.

14. *A facilitating mechanism or network should be developed in Missouri which gives each institution in the state access to specialized computing resources which might be available at other institutions. Independent institutions should be allowed access to the network on a cost reimbursement basis.*

Most of the top administrators (72%) rated this objective as appropriate or extremely appropriate. One-quarter (24%) considered it inappropriate or extremely inappropriate; 4% rated it as neutral. None of the UM administrators, only two of the executives at four-year institutions, and three at two-year institutions gave this a negative rating.

15. *A CAI center should be implemented in Missouri which provides access to existing instructional programs for public institutions in the state. Access to CAI programs should be made available to public schools as well as to higher education institutions.*

Over half (56%) of all the executives considered this objective as appropriate or extremely appropriate. A greater percentage of the two-year administrators (91%) than four-year (33%) or UM (20%) administrators considered this appropriate or extremely appropriate. Most of the UM administrators (60%) considered it inappropriate or extremely inappropriate. A third of the four-year presidents (33%) and only one of the two-year presidents gave this a low rating on appropriateness.

16. *Computer support for faculty and student research should be provided as needed by these educational activities. As part of the continuing state-wide planning, a special committee should examine the needs in this area, identify existing deficiencies, and make recommendations that can be addressed on a state-wide basis.*

Only forty percent of the executives considered this objective to be appropriate or extremely appropriate. One-third (32%) rated it as neutral, and the remainder (28%) rated it as inappropriate or extremely inappropriate. A larger percentage of the negative responses were registered at UM (60%) than at the four-year (33%) or two-year (9%) institutions.

17. *A state-wide organization should be created in Missouri which facilitates sharing of computer resources (including hardware and software), coordinates state-wide consulting services for computing, facilitates the development of instructional and other academic computing, and serves as a clearinghouse for information about available computer resources. Such an organization would not necessarily have a hardware network component, but it would keep an up-to-date inventory of computer hardware in public higher education institutions, including information on equipment that might be available for redistribution.*

Over half (56%) of the administrators rated this objective as appropriate. Most of the positive responses came at the two-year institutions, where 74% gave it a positive rating compared to 44% at the four-year institutions and 40% at the University of Missouri. Only 24% considered this objective inappropriate or extremely inappropriate; two of the negative responses were at the University of Missouri (40% of the UM responses), three at four-year institutions (33%) and one at two-year institutions (9%).

Objective Ratings

Tables 1 and 2 present the results from the State-Wide Objectives Assessment questionnaire. The results for each segment of institutions--University of Missouri Central Administration and campuses, other state four-year institutions and state two-year institutions--are presented in addition to the results from all institutions. An Analysis of Variance (ANOVA) test of statistical significance was used to determine meaningful differences between the responses by the three institutional segments.

The general-objective statements included in the questionnaire were, with two exceptions, considered appropriate by the top administrators. Table 1 presents the average mean score on the five-point rating scale for each general objective statement. On this scale, 3 is considered neutral, 4 and 5 are appropriate or extremely appropriate, and below 3

TABLE 1. APPROPRIATENESS RATING OF GENERAL OBJECTIVE STATEMENTS

	Average	By Segment			
	All Institutions	Univ. of Mo.	Four-year	Two-year	Sig.
General Objective 1A	4.8	5.0	5.0	4.5	
General Objective 1B	4.4	5.0	4.4	4.0	
General Objective 1C	4.8	5.0	4.8	4.8	
General Objective 1D	3.5	3.6	3.3	3.5	
General Objective 2	4.6	5.0	4.3	4.6	
General Objective 3	4.0	4.0	3.7	4.0	
General Objective 4	3.5	2.8	3.6	3.7	

Source: Computer Policy Task Force, Objectives Assessment Questionnaire, 1979

TABLE 2. RATING OF SPECIFIC OBJECTIVE STATEMENTS

	Appropriateness ?					Being Met ?				
	Total	Univ. of Mo.	Four-year	Two-year	Sig.	Total	Univ. of Mo.	Four-year	Two-year	Sig.
Specific Objective 1	3.8	3.0	4.0	4.0		2.5	4.5	2.4	1.8	**
Specific Objective 2	4.4	4.2	4.4	4.4		2.5	3.6	2.7	1.9	*
Specific Objective 3	4.4	4.8	4.3	4.2		2.6	4.2	2.7	1.9	**
Specific Objective 4	4.0	4.8	4.1	3.6		2.4	4.5	2.3	1.8	**
Specific Objective 5	4.5	4.2	5.0	4.3		2.9	4.5	3.4	2.2	**
Specific Objective 6	4.4	4.8	4.0	4.5		2.5	4.3	2.3	2.0	**
Specific Objective 7	3.1	2.2	2.9	3.7		1.8	4.0	1.6	1.6	*
Specific Objective 8	3.4	2.8	2.9	4.0		1.7	3.0	1.3	1.6	*
Specific Objective 9	4.6	4.2	4.6	4.7		3.2	4.3	3.7	2.5	**
Specific Objective 10	3.5	2.5	3.4	3.9		2.0	3.0	1.9	2.0	
Specific Objective 11	3.8	3.8	3.2	4.4		2.1	3.0	1.6	2.5	
Specific Objective 12	3.6	4.0	3.4	3.5		1.8	3.3	1.5	1.6	**
Specific Objective 13	4.4	4.4	4.2	4.5		2.2	3.5	2.1	1.7	*
Specific Objective 14	3.8	3.6	3.7	4.0		NA	NA	NA	NA	
Specific Objective 15	3.4	2.2	2.8	4.4	**	NA	NA	NA	NA	
Specific Objective 16	3.3	3.0	3.0	3.6		NA	NA	NA	NA	
Specific Objective 17	3.5	2.8	3.1	4.2		NA	NA	NA	NA	

Source: Computer Policy Task Force Objective Assessment Questionnaire, 1979
* Significant difference at .05 level
** Significant difference at .01 level

is considered inappropriate. For objective statement one, academic, library, and administrative uses were considered appropriate, while public service received a neutral response.

General objectives 2 and 3 also scored high on the appropriateness ratings by each segment of institutions. These results support efficiency and effectiveness in higher education computing (objective 2) and sharing development costs when appropriate (objective 3) as possible state-wide objectives. The final objective statement, that state-wide planning should take place on a regular and routine basis, received a neutral rating. The differences between the ratings for each institutional segment were not significant for the general-objective statements.

Specific-objective statements, Table 2, were rated both for their appropriateness on a five-point scale rating how they are currently being met. With a few exceptions, the specific objectives were rated consistently by all institutional segments on the appropriateness scale, while the degree to which these objectives were currently being met varied by institutional segment.

MAR 7 1979

Appendix I

Alternative Strategies for Computing
by Donald M. Norris

Purpose of this Paper

The purpose of this paper is to identify the major, alternative strategies that confront a state such as Missouri which is considering cooperative computing. These strategies include not only particular types of hardware configuration, but mechanisms for sharing software and personnel expertise, as well. Besides identifying these major strategies, the discussion suggests the pros and cons of each strategy and specifies the particular circumstances which experience has proven to favor particular approaches.

It is impossible, of course, to address strategies for cooperation in a vacuum. Conditions vary markedly from state to state. The popularity of different types of cooperative arrangements have changed over time. Therefore, the following discussion proceeds historically to discuss how different cooperative arrangements have emerged in response to changing needs and technology. Particular emphasis is placed on the types of networking arrangements which seem particularly appropriate in the educational computing environment of the present and short-term future.

Initial Development of Networks and Cooperation

The initial development of networks and sharing arrangements in higher education occurred in an environment in which fully centralized data processing operations were most cost effective. Bigger was indeed better. Moreover, the equation of resources in computing was such that hardware was the predominant expense, even though software and personnel expenditures were significant, hardware was the focus of attention for the state review agencies and coordinating boards.

It is not surprising that these conditions, which existed in the mid-1960's through early 1970's, encouraged the formation of centralized, single facility sharing. For example, the Triangle Universities Computation Center (TUCC) in North Carolina represented a single, independent computer organization which was established by three geographically proximate universities to "wholesale" computing services. A more common sort of arrangement was the so-called "star network" in which existing, major computing facilities at a research university were made available to "computing have-nots" through remote job entry. Many star networks that were created or formalized by statewide planning processes during this period were remnants of NSF-sponsored star networks.

The single facility sharing approach remains a viable alternative where geographical proximity or other factors enable the establishment of a single facility to serve several institutions. Star networks remain satisfactory solutions to providing computing have-nots with access to certain types of applications. However, changes in technology and in the resource equation of computing have made star networks far less attractive than they once were for many applications.

The late 1960's and early 1970's marked the heyday of statewide planning for computing in higher education. In many cases, these planning processes did little more than identify goals for computing and cooperation among state institutions. Sometimes, the plans identified a so-called "enabling network", that is, the recommended arrangement which would be used if the state decided, after further study, to engage in cooperative activities. Other states went so far as to actually mandate particular sharing arrangements. In any case, it was recognized that agreeing upon how cooperation would be approached was just as important as agreeing upon what would be shared. Many states opted for implementing organizations which were really only committees of institutional representatives reporting to a member

of the coordinating board staff. Others, however, established independent legal bodies, also called "not-for-profit corporations" to provide whatever computing or facilitating services were deemed advisable.

The not-for-profit corporation was an important concept. It established a new type of organization whose functions could run the gamut from actually delivering or brokering computing services through serving as a centralized purchasing agent and functioning as a clearinghouse for information on computing. Moreover, such an organization could serve as an "honest broker" in deciding on the validity of institutions' requests for additional computing power. In some states, such as Minnesota, these organizations were large and comprehensive; in others, such as Illinois, the not-for-profit corporation was smaller and more limited in its functions.

While single facility or star networks were the predominant modes during this period, another type of computer configuration was developing. The so-called "distributed network" linked the major computing facilities of several universities in such a way that each institution could draw on the general-purpose or specialized resources of the other participants. Often this was done "transparently" so the user was not aware of where his job was being processed. Examples of early distributed networks are the MERIT Network, which links computing facilities of the University of Michigan, Michigan State University and Wayne State University. Also, the ARPANET links the computers at a number of major universities and research centers across the world. These sorts of distributed networks are extremely valuable in making available to sophisticated computer users the special-purpose facilities at other major centers. There are also economies that can be realized by balancing the loads among the major computing facilities of participants. On the other hand, there must be a genuine commitment from the participating institutions to make these sorts of networks work.

Changes in the Nature of Computing

The conditions that encouraged the development of early cooperative networks have changed significantly since the early 1970's. A number of new developments have caused major revisions in our thinking about networking. There have been revolutionary changes in the field of mini- and micro-processing. Whole new families of mini- and micro-computers are available, thus making "decentralized" computing a more viable alternative. In addition, the equation of computing resources has been altered so that software and personnel resources are now viewed as predominant. Software and personnel costs are less susceptible to reduction through technological improvement and more susceptible to inflation. In addition, as institutions have developed greater computer experience and capabilities, there are fewer computing have-nots, and the focus is more on specialized, higher-order applications. Finally, experience with existing networking arrangements and with highly centralized computing organizations have lead to a healthy understanding of the limitations of these approaches.

These changes have not eliminated the needs for cooperation nor the potentials for networking. Rather, they have redefined which arrangements make sense. Many applications which once would have been addressed with a star network are now more appropriately handled with mini- or micro-processors. The range of options has increased and an institution can pick and choose different approaches. This condition has increased the danger of fragmentation, duplication, and redundancy, however. It is also more difficult in today's environment for any one computer center director to be familiar with the full range of products and services available.

There have been several results from these interacting technological and environmental changes. Decentralized computing has become a more viable option. Distributed networking has also assumed greater importance. But whereas earlier distributed

networks linked large computers, distributed systems of mini-computers have expanded considerably the potential applications of this mode of networking. In addition, the availability of different levels of economic computing power has led to "hierarchical networking" in which mini- or micro-processors may be linked to larger computers so that different types and levels of user requirements are taken care of on different equipment. In some circles, hierarchical computing is referred to as "distributed computing" in the sense that jobs are routed to whichever hierarchical facility best suits their needs. Obviously, a further development has been hierarchical, distributed networking which utilizes a hybrid version of both approaches.

Finally, considerable interest is being displayed in so-called "facilitating networks". These networks do not serve as facility managers, directly to provide computing services to their users. Rather, they may function as clearinghouses for information on networking possibilities, software systems available from other institutions or proprietary sources, and new computing developments. They may provide leadership through training programs, serving as advocates for increased computing power, and raising the consciousness of institutions which need to improve their computing capabilities. The increasing availability of proprietary software systems, networks of specialized users, and new developments in computing have accentuated the dividends available from such a network. By performing these functions, facilitating networks can help overcome the increased dangers of fragmentation of computing.

Responses to Changing Conditions

In response to these conditions, existing networks are modifying their functions and/or structure. Often this means emphasizing certain functions, such as centralized

purchasing and facilitating services, which they have provided all along; sometimes it involves moving into new areas of service. Newly created networks are also reflecting changing conditions in their organizational form and services provided.

In the January presentation before the Computing Policy Task Force,the experiences of three state networks were related. The Minnesota Educational Computing Consortium (MECC) has responded to the changing computing environment with a number of initiatives. For example, it has orchestrated a task force to evaluate specifications for micro-processors; utilized its centralized purchasing capabilities to purchase micro-processors for all state users,at a significant savings; and has "down-loaded" to the micro-processors the software for its instructional timesharing applications. In doing this, MECC realized real dollar savings and avoided the waste, duplication, and fragmentation which would have resulted from an uncoordinated approach. In West Virginia, WVNet has created an hierarchical star network linking the state institutions. Jobs are routed to the appropriate point on the WVNet for most efficient/effective processing. Planning and coordinated development reduce the possibility of unwarranted redundancy. Recognizing that the sharing of people (expertise) and software will continue to be important in the future, as it has been in the past, NCECS in North Carolina is moving toward a facilitating approach. Originally a distributor of TUCC computing power, NCECS is developing facilitating functions to supplement its traditional star network services. New functions include 1) providing specialized service via access to other university computing centers, such as host facilities associated with EDUNET (EDUCOM's prototype national network) and HEN (Health Education Network), and 2) Micro-computer support services (still in the planning stages, but expected to be similar to those offered by MECC).

There have been few new statewide networks which have developed over the past few years. This is largely due to two factors: 1) The new computing environment

discourages state-wide planning and networking of the style popular some years ago, and 2) Earlier statewide efforts either solved the problems which existed or demonstrated that the problems were not severe. Kentucky did establish a new state-wide computer network in 1976 and they opted for a hierarchical, distributed network. The major computing facilities at the University of Louisville, and the University of Kentucky were linked in a distributed manner, and lower capacity lines then linked the five state universities to the major sites; the eleven community colleges were then tied into the state universities. This approach should not be taken to represent the wave of the future, however.

Colorado has also taken an interesting approach. Previous plans calling for the establishment of an independent, not-for-profit corporation for computing in Colorado higher education had not been implemented fully nor effectively. The newest approach calls for the establishment of a higher education Computing Group in the State Department of Administration, guided by appropriate advisory boards. This Computing Group would coordinate planning; develop budgets for higher education computing and carry these budgets through the state's appropriation process; and provide a series of facilitating functions including training, staff development, promotion of cooperation, identification of software packages, and coordination of hardware acquisitions. While the organizational location of the Computing Group is unusual (and due largely to the Colorado Coordinating Commission's low prestige in computing matters) the facilitating and planning functions of this organization follow a pattern that is likely to be repeated by other states.

The Functions of a Facilitating Organization

While most observers feel that the facilitating network is likely to be the most common type of computing cooperative in the future, it is difficult to identify precisely what a facilitating network is. There are few "pure" examples of true facilitating organizations. The reasons are that different facilitating functions make sense for different computing environments and many existing networks are embracing facilitating functions in addition to their other activities.

It is important to recognize that a facilitating network cannot be all things to all people. Such a network makes available a range of services and functions from which institutions may choose whatever suits their needs. Some institutions may choose fully to utilize these services, while others may not need to. The primary goal of a facilitating organization is not control, but providing optional services. To be successful, the network must provide services that address real needs and create an incentive structure that rewards institutions for utilizing its services appropriately. The following sorts of functions are possible for a facilitating organization.

Providing leadership for the state in computing developments. The facilitating organization could keep informed of national developments in computing, networking, and other cooperative matters. The director of the network could maintain contact, as a member, with CONDUIT and EDUNET (which attach a distinct cost advantage to having a single contact person) and with national resource-sharing organizations, such as EDUCOM, HEN, Library networks, CAUSE, ICPSR, PLATO, and others. The

director could both serve as a clearly identified contact point and communicate with computing persons in the state on these national developments. The facilitating network could also provide a "local distributor function" by facilitating access by Missouri institutions to EDUNET suppliers, for example. The facilitating network could also assume a leadership role in coordinating multi-institution grant proposals to increase computer power or attempt new applications in Missouri. The competition for such funds is getting progressively more difficult, and joint proposals have a greater chance of success.

Serve as information clearinghouse. The facilitating organization could serve as a central collection point for information on what is going on in Missouri and across the nation. Information on national resources and software packages could be maintained. The network could maintain a documentation library and/or a central software library; it should probably distribute a newsletter dealing with such matters.

While individual computing center directors might also maintain an active knowledge of national developments, cooperative possibilities, and other factors, the facilitating network creates a single individual or group of individuals, removed from energy-draining operational responsibilities, who can focus on these issues. Knowledgable computing center directors (together with certain faculty and other staff) would serve as resource persons to the central organization, which through its activities would enable all institutions to benefit from their expertise and leadership. This arrangement will enhance the level of understanding of both the network staff and computing center directors. Moreover, the facilitating network provides a mechanism for assisting "have-not" institutions, which have relatively little sophistication in computing, in taking advantage of cooperative possibilities.

Training and staff development. The facilitating network can hold special workshops for faculty, and can mobilize a critical mass of expertise that might not be available to the individual institutions. These activities could be cooperative efforts in conjunction with institutions which might already have such programs. Discipline-oriented faculty workshops have been especially well received in some states.

Direct planning for higher education computing in Missouri and measure achievement of statewide and institutions' goals for computing. The facilitating network could function as an active, independent voice in support of planning for achievement of state goals for increased computing power in Missouri. Such an organization would need to balance institutional advocacy and responsible service to the state. If successful in achieving this balance, the need for additional scrutiny from the state agency responsible for data processing review could be eliminated.

Functioning as computing advocate and raising the consciousness of under-served institutions. In conjunction with its planning role, the facilitating network could alert under-served institutions to the services which they could expect to develop locally or obtain off-campus. Emerging institutions would not need to go through all the developmental stages of computing and make all of the same mistakes in expanding computing power. The network could help assure that such growth would occur in the most effective manner.

Assist in preparation of specifications, equipment selection, and achievement of favorable terms of purchase/lease. Through participation in the planning activities, the facilitating network could assist institutions in deciding on new equipment,

and could put together a purchase package which would be highly cost-efficient. This would go beyond merely using a state purchasing/bid system; it could involve both cost savings and the selection of the best mix of systems for the state institutions.

Provide software development and instructional timesharing service, if conditions warrant. Instructional timesharing or development of instructional software is the area in which the central organization would most likely be called on to provide actual service. Such instructional services might be available either from a central site, from on-campus micro-computers, or a combined approach with "down-loading" of software.

In considering these functions which the facilitating network might assume, it is important to understand that the whole is greater than the sum of its parts. A facilitating network is better able to provide assistance in purchasing and selecting equipment by virtue of its participation in statewide planning; it is more effective in assisting under-served institutions through serving as a clearinghouse of information for all institutions. Even if the institutions in a state perform one or more of the major functions of a facilitating network in an effective and coordinated manner, the state can profit from a clearly identified, active facilitating organization.

To function effectively such a facilitating organization would need to be staffed with a director who possessed sufficient stature and knowledge of computing to be able to deal with computing center directors on relatively equal footing. At the very least, such a person would probably need to be supported by one or two technical staff and by secretarial staff. This organization would need to be supported by various advisory groups. While the facilitating organization would

need to establish its credibility and independence, there are a number of suitable organizational placements for it: 1) an independent legal body (not-for-profit-corporation), 2) an office of the State Department of Administration, 3) an agency of the Department of Higher Education, 4) affiliation with an educational institution, or group of institutions. It might be feasible to identify some functions, such as maintenance and analysis of a statewide facilities inventory, which could be contracted out to an individual institution(s).

A facilitating organization would seem to be especially appropriate for a state such as Missouri. Many of the institutions are relatively under-served by computing, and while cooperative interaction and developments have been increasing, there is substantial room for improvement. A facilitating organization with an articulate, capable staff could argue convincingly for increased computing power and could coordinate this movement into the mainstream. It could also provide a number of tangible, useful services. Such a network, providing a range of optional services from which institutions could choose, would also involve in some way most of the institutions in Missouri, from community colleges to the University of Missouri.